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INTRODUCTION

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Thesaurus should be consulted in examining the current indexing vocabulary, including associated cross-reference structure. Only the subject terms that have been selected to describe the documents abstracted in this issue appear in the subject index. Copies of the *NASA Thesaurus* may be obtained from the National Technical Information Service or the U.S. Government Printing Office at $8.50 for the three-volume set. The first two volumes of this Thesaurus, consisting of the alphabetical listing of subject terms (A–Z), have been superseded by the following single-volume publication: *NASA Thesaurus Alphabetical Update* (September 1971) (NASA SP-7040), available from NTIS for $6.00. (Volume III of the Preliminary Edition consists of the following ancillary aids to vocabulary selection: heirarchical display of index terms, category term listing, permuted index, and a listing of postable terms only.)

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01 Aerodynamics **1687**
Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 32 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

02 Aircraft **1690**
Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc.; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

03 Auxiliary Systems **1694**
Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

04 Biosciences **1696**
Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

05 Biotechnology **1701**
Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

06 Chemistry **1704**
Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

07 Communications **1706**
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08 Computers **1711**
Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

09 Electronic Equipment **1716**
Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors, integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

10 Electronics **1721**
Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

11 Facilities, Research and Support **1722**
Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

12 Fluid Mechanics **1733**
Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

13 Geophysics **1737**
Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

14 Instrumentation and Photography **1746**
Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders, transducers; aerial photography; and telescopes and cameras.

15 Machine Elements and Processes **1753**
Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

16 Masers **1758**
Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State.

17 Materials, Metallic **1759**
Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

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18 Materials, Nonmetallic 1764
Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

19 Mathematics 1766
Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

20 Meteorology 1768
Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

21 Navigation 1771
Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

22 Nuclear Engineering 1777
Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

23 Physics, General 1779
Includes acoustics, Cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology, and 29 Space Radiation.

24 Physics, Atomic, Molecular, and Nuclear 1781
Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

25 Physics, Plasma 1785
Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

26 Physics, Solid-State 1788
Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

27 Propellants 1791
Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

28 Propulsion Systems 1792
Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

29 Space Radiation 1796
Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

30 Space Sciences 1797
Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbits and trajectories. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

31 Space Vehicles 1805
Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

32 Structural Mechanics 1811
Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

33 Thermodynamics and Combustion 1815
Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

34 General 1817
Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

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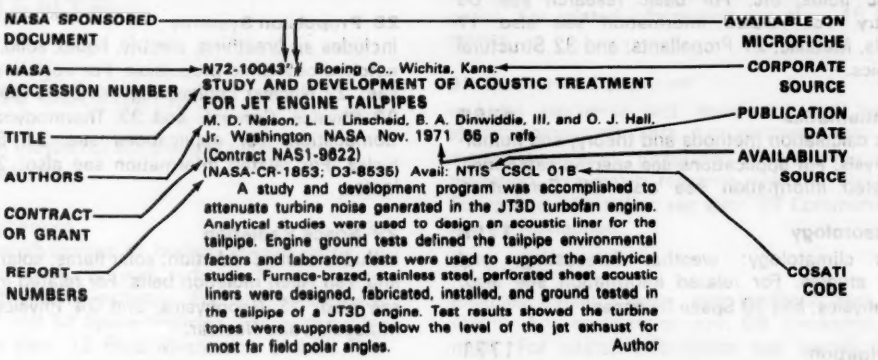
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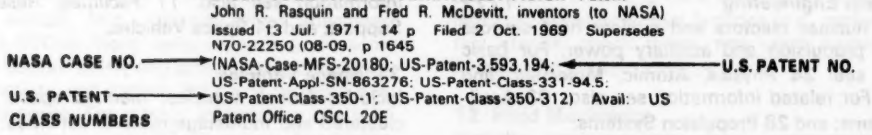
N72-10043*# Boeing Co., Wichita, Kans.
STUDY AND DEVELOPMENT OF ACOUSTIC TREATMENT FOR JET ENGINE TAILPIPES
M. D. Nelson, L. L. Linscheid, B. A. Dinwiddie, III, and O. J. Hall, Jr. Washington NASA Nov. 1971 66 p refs
(Contract NAS1-9822)
(NASA-CR-1853; D3-8535) Avail: NTIS CSCL 01B
A study and development program was accomplished to attenuate turbine noise generated in the JT3D turbofan engine. Analytical studies were used to design an acoustic liner for the tailpipe. Engine ground tests defined the tailpipe environmental factors and laboratory tests were used to support the analytical studies. Furnace-brazed, stainless steel, perforated sheet acoustic liners were designed, fabricated, installed, and ground tested in the tailpipe of a JT3D engine. Test results showed the turbine tones were suppressed below the level of the jet exhaust for most far field polar angles. Author

PATENT CITATION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U.S. PATENT CLASS NUMBERS
U.S. PATENT NO.
N72-12440* Auburn Research Foundation, Inc., Ala.
LASER COOLANT AND ULTRAVIOLET FILTER Patent
John R. Rasquin and Fred R. McDevitt, inventors (to NASA)
Issued 13 Jul. 1971 14 p Filed 2 Oct. 1969 Supersedes N70-22250 (08-09, p 1645
(NASA-Case-MFS-20180; US-Patent-3,593,194;
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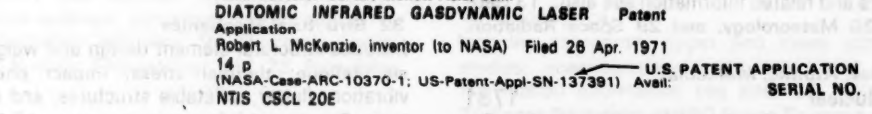
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N72-10432*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
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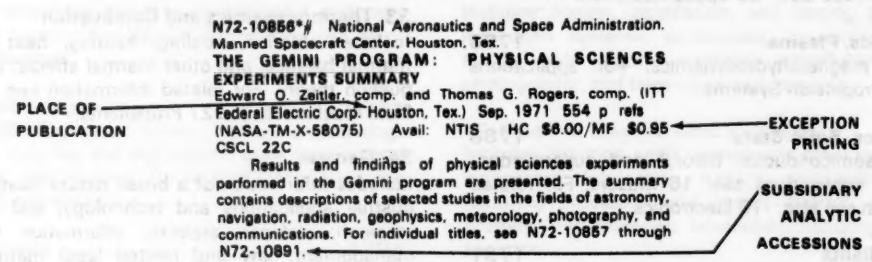
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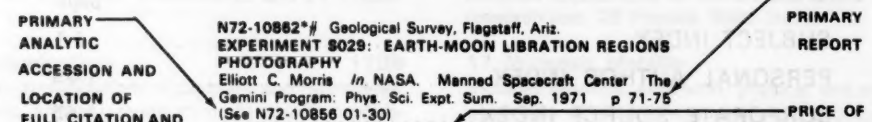
EXCEPTION PRICING
SUBSIDIARY ANALYTIC ACCESSIONS
N72-10856*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
THE GEMINI PROGRAM: PHYSICAL SCIENCES EXPERIMENTS SUMMARY
Edward O. Zeitler, comp. and Thomas G. Rogers, comp. (ITT Federal Electric Corp. Houston, Tex.) Sep. 1971 554 p refs
(NASA-TM-X-58075) Avail: NTIS HC $6.00/MF $0.95 CSCL 22C
Results and findings of physical sciences experiments performed in the Gemini program are presented. The summary contains descriptions of selected studies in the fields of astronomy, navigation, radiation, geophysics, meteorology, photography, and communications. For individual titles, see N72-10857 through N72-10891.

SUBSIDIARY ANALYTIC CITATION


PRIMARY ANALYTIC ACCESSION AND LOCATION OF FULL CITATION AND ABSTRACT
PAGES IN PRIMARY REPORT
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N72-10862*# Geological Survey, Flagstaff, Ariz.
EXPERIMENT S029: EARTH-MOON LIBRATION REGIONS PHOTOGRAPHY
Elliott C. Morris In NASA. Manned Spacecraft Center The Gemini Program: Phys. Sci. Expt. Sum. Sep. 1971 p 71-75
(See N72-10856 01-30)
Avail: NTIS HC $6.00/MF $0.95 CSCL 14E

VOLUME 10 NUMBER 13 / JULY 8, 1972

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N72-21991*+ National Aeronautics and Space Administration, Washington, D.C.

AERONAUTICAL ENGINEERING, A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 15

Feb. 1972 124 p refs

(NASA-SP-7037(15)) Avail: NTIS CSCL 01B

This special bibliography lists 363 reports, articles, and other documents introduced into the NASA scientific and technical information system in January 1972. Emphasis is placed on engineering and theoretical aspects for design, construction, evaluation, testing, operation and performance of aircraft (including aircraft engines) and associated components, equipment and systems. Also included are entries on research and development in aeronautics and aerodynamics and research and ground support for aeronautical vehicles. Author

N72-21992 National Aeronautical Establishment, Ottawa (Ontario).

DYNAMIC INTERFERENCE EFFECT ON DYNAMIC STABILITY OF DELTA-WING SHUTTLE IN ABORT SEPARATION AT MACH 2.0

K. J. Orlik-Rueckzmann and J. G. LaBerge Nov. 1971 57 p refs

(LTR-UA-18) Avail: Issuing Activity

Damping-in-pitch was measured at Mach 2 on a delta-wing orbiter in close proximity of a synchronously oscillating canard booster. For the single position of the two vehicles that was investigated, it was found that the associated dynamic interference may result in values of the orbiter damping that are between +13 and -8 times the interference-free value, depending on the phase-angle between the two motions. This is in contrast to the static interference caused by a non-oscillating booster, that has previously been shown to have only a minor effect on orbiter damping. It has been found also that the dynamic interference may reduce the frequency of orbiter oscillation, increasing the probability that it may become synchronous with that of the booster. More work is needed to increase our understanding of the effect of dynamic interference so that the design and operation requirements for a safe abort separation can be properly formulated. Author

N72-21993*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

SUBSONIC PRESSURE DISTRIBUTIONS AROUND A SOLID MODEL OF AN INFLATABLE DECELERATOR ATTACHED TO THE BASE OF AN OGIVE-CYLINDER

James Wayne Sawyer Washington Apr. 1972 29 p refs

(NASA-TM-X-2535; L-8188) Avail: NTIS CSCL 01A

A wind-tunnel investigation was conducted at free-stream Mach numbers from 0.20 to 1.00 and corresponding Reynolds numbers, based on maximum afterbody diameter, from 2.25 x one million to 6.90 x one million on a solid model of an attached inflatable decelerator (AID) connected to the base of an ogive-cylinder. Tests were conducted to obtain ram-air and surface pressure distributions about the AID. AID shapes derived for subsonic deployment are dependent on the pressure distributions used in their derivation, and the different shapes obtained are dependent on the Mach number for which the design is made. The resulting pressure distributions were used in a design program to obtain new shapes which were compared with the original pressure-distribution shape. Author

N72-21994*# General Electric Co., Evendale, Ohio. Aircraft Engine Group.

ACOUSTIC TESTING OF A 1.5 PRESSURE RATIO, LOW TIP SPEED FAN (QEP FAN B SCALE MODEL)

S. B. Kazin, W. R. Minzner, and J. E. Pass [1972] 111 p (Contract NAS3-12430)

(NASA-CR-120789) Avail: NTIS CSCL 01A

A scale model (0.484 scale factor) of a single stage fan designed for a 1.5 pressure ratio and 1160 ft/sec tip speed was tested to determine its noise characteristics. The fan had 26 blades and 60 outlet guide vanes, with vanes spaced two rotor blade aerodynamic chords from the blades. The effects of speed, exhaust nozzle area and fan frame acoustic treatment on the scale model's noise characteristics were investigated. Author

N72-21995# National Aerospace Lab., Tokyo (Japan).

A CALCULATION OF THE PROFILE DRAG OF AIRFOILS IN COMPRESSIBLE FLOW

Yoji Ishida Nov. 1971 18 p refs In JAPANESE; ENGLISH summary

(NAL-TR-253) Avail: NTIS

A method is presented for predicting the profile drag of airfoils at subcritical and supersonic Mach numbers. The method consists of four steps of calculations: (1) calculation of the laminar boundary layer by using the Stewartson-Illingworth transformation and Thwaites method; (2) calculation of the transition point; (3) calculation of the turbulent boundary layer by Green's method; and (4) calculation of the wake. The calculated or experimental velocity distributions on airfoils must be given in advance, and the transition point must also be given as a parameter. Profile drag was calculated for several types of airfoils at subcritical Mach numbers. A comparison was made with experimental data. This method is also applicable to calculation of profile drag and prediction of boundary layer behavior for airfoils in supersonic flow. It is applied to the biconvex airfoils as an example. Author

N72-21996# Aeronautical Research Labs., Melbourne (Australia).
AN INTRODUCTION TO DYNAMIC DERIVATIVES. THE CONCEPT OF DERIVATIVES
G. F. Forsyth Jul. 1971 37 p refs
(ARL/A-Note-330; ISBN-642-97701-1) Avail: NTIS

The meaning and importance of various unsteady aerodynamic quantities are discussed. Mathematical analyses of small displacements from the stable condition are presented. The principle variables contributing to aircraft instability are described. Subjects of discussion include: (1) the variable set, (2) similarity invariants, (3) dynamic invariants, and (4) stiffness and damping. Author

N72-21997*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPLORATORY INVESTIGATION OF LIFT INDUCED ON A SWEPT WING BY A TWO-DIMENSIONAL PARTIAL-SPAN DEFLECTED JET AT MACH NUMBERS FROM 0.20 TO 1.30
Francis J. Capone Washington Apr. 1972 80 p refs
(NASA-TM-X-2529; L-8177) Avail: NTIS CSCL 01B

An exploratory investigation was conducted in the Langley 16-foot transonic tunnel at Mach numbers from 0.20 to 1.30 to determine the induced lift characteristics of a body and swept-wing configuration having a partial-span two-dimensional propulsive nozzle with exhaust exit in the notch of the swept-wing trailing edge. The Reynolds number per meter varied from 4,900,000 to 14,030,000. The effects on wing-body characteristics of deflecting the propulsive jet in the flap mode at nominal exhaust-nozzle deflection angles of 0 deg and 30 deg were studied for two nozzle designs with different geometry and wing spans. Author

N72-21998*# Iowa State Univ. of Science and Technology, Ames. Engineering Research Inst.
NUMERICAL SOLUTION OF FLOWFIELDS BEHIND RECTANGULAR WINGS Final Report
Dale Anderson and Jerald Vogel Jul. 1971 79 p refs
(Grant NGR-16-002-029; Proj. 859-S)
(NASA-CR-126214; ISU-ERI-AMES-71015) Avail: NTIS CSCL 01A

The numerical solution of flow fields behind rectangular wings is described. Subjects discussed are: (1) evaluation of various differencing methods applied to the hyperbolic partial differential equations encountered in gas dynamics, (2) application of the numerical differencing techniques to the wedge flow, two dimensional shock reflection for the three dimensional finite thickness wing at zero degrees angle of attack, and (3) calculation of preliminary results for wedge flows using optimum differencing methods. Author

N72-21999# Weapons Research Establishment, Salisbury (Australia).
AN EXPLANATION OF THE NEGATIVE MAGNUS SIDE FORCE EXPERIENCED BY A SPINNING, INCLINED OGIVE-CYLINDER
C. A. J. Fletcher Nov. 1971 55 p refs
(WRE-TN-489(WR/D)) Avail: NTIS

An explanation for the negative Magnus lift force on a spinning two-dimensional cylinder is presented. Through the use of the impulsive flow analogy the explanation is applied to a spinning axisymmetric ogive cylinder at incidence. The explanation predicts a negative Magnus side force in the critical cross-flow Reynolds number regime when a positive side force exists. A potential flow model is developed which predicts the side forces qualitatively, given the separation positions and vortex positions. Author

N72-22000*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
A STUDY ANALYSIS OF CABLE-BODY SYSTEMS TOTALLY IMMERSED IN A FLUID STREAM
James D. DeLaurier Washington Apr. 1972 93 p refs
(Grant NGL-05-020-243)
(NASA-CR-2021; SUDAAR-411) Avail: NTIS CSCL 01A

A general stability analysis of a cable-body system immersed in a fluid stream is presented. The analytical portion of this analysis treats the system as being essentially a cable problem, with the body dynamics giving the end conditions. The mathematical form of the analysis consists of partial differential wave equations, with the end and auxiliary conditions being determined from the body equations of motion. The equations uncouple to give a lateral problem and a longitudinal problem as in first order airplane dynamics. A series of tests on a tethered wind tunnel model provide a comparison of the theory with experiment. Author

N72-22001# Advisory Group for Aerospace Research and Development, Paris (France).
SOME RECENT DEVELOPMENTS IN PLANAR INVISCID TRANSONIC AIRFOIL THEORY
H. Yoshihara (Gen. Dyn./Convair, San Diego, Calif.) Feb. 1972 38 p refs
(AGARD-AG-156; AGARD; graph-156) Avail: NTIS

Some recent efforts to calculate planar inviscid supercritical flow over airfoils are reviewed giving typical results achieved. The hodograph procedures of Nieuwland and Boerstoel, and Garabedian and Korn are first reviewed which yield shockless profiles. The unsteady finite difference procedure of Mannus and Yoshihara is then described and its use then illustrated by several lifting examples with shocks. This is then followed by a description of two steady procedures. The first is that of Murman and Cole, who used a line relaxation procudure to solve a boundary value problem composed of the transonic perturbation equations with planar boundary conditons. The second is the procedure of Steger and Lomax who used the exact equations, and quasi-planar boundary conditions, and the finite difference relaxation procedure of Murman and Cole. The review is concluded by making a brief assessment of the various methods. Author

N72-22002# Aeronautical Research Council (Gt. Brit.). Aerodynamics Dept.
THE LINEARIZED SUBSONIC FLOW OVER THE CENTRE-SECTION OF A LIFTING SWEPT WING
Patricia J. Rossiter 1970 33 p refs Supersedes RAE-TR-69072
(ARC-R/M-3630; BR-19914; RAE-TR-69072) Avail: NTIS; HMSO 90p; PHI $3.65

The linearized equation for the velocity potential of subsonic flow past a semi-infinite plane sector has eigensolutions. These determine the singular behaviour of the loading, according to the linearized theory of subsonic flow, at the leading and trailing edges of the center section of a swept wing. The eigensolutions are proportional to a positive power of the distance from the apex of the sector. Values of the exponents of this factor for the first two eigensolutions are calculated as functions of the apex angle, using a finite difference approximation to the partial differential equation. The first of these corresponds to the strength of the singularity in the loading at the apex of a swept wing and the second, which is compatible with the Kutta-Joukowski condition, describes the rate at which the loading tends to zero as the trailing edge root is approached. Author

N72-22003*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOME EFFECTS OF EXTERNAL STORES ON THE STATIC STABILITY OF FIGHTER AIRPLANES
M. Leroy Spearman Washington Apr. 1972 36 p refs Presented at the Aircraft/Stores Compatibility Symp., Dayton, Ohio, 7-9 Dec. 1971
(NASA-TN-D-6775; L-7906) Avail: NTIS CSCL 01B

Fighter airplanes may have a seemingly limitless number of external store arrangements. Some practical considerations and some aerodynamic considerations must be taken into account in the arrangements of the external stores. The nature of the

problems concerning the type of store arrangement involved and the type of airplane on which the stores are installed are reported. Author

N72-22004*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INVISCID ANALYSIS OF JET INJECTION BETWEEN TWO MOVING STREAMS
Marvin E. Goldstein and Robert Siegel Washington Apr. 1972 57 p refs
(NASA-TN-D-6780; E-6583) Avail: NTIS CSCL 01A

An analytical method is developed for determining the flow interaction when a two-dimensional jet is injected between two moving streams. The jet is flowing out of channel and is turned as it enters between the external streams. The local velocity variation resulting from the flow interaction provides a static pressure variation along the jet bounding streamlines that is a priori unknown. Hense, the flow must be obtained by coupling the three flow regions (the jet and the free stream on either side) along the jet boundaries. Both external streams have the same total pressure, which is different from that in the jet. The solution is for the condition that the total pressure in the jet does not differ from the free-stream value by a large amount compared with the free-stream dynamic head. Results are given for the shape of the jet boundaries for various injection configurations. Author

N72-22005*# Avco Corp., Wilmington, Mass.
A METHOD FOR ANALYZING DYNAMIC STALL OF HELICOPTER ROTOR BLADES
Peter Crimi and Barry L. Reeves Washington NASA May 1972 110 p refs
(Contract NAS1-10213)
(NASA-CR-2009) Avail: NTIS CSCL 01B

A model for each of the basic flow elements involved in the unsteady stall of a two-dimensional airfoil in incompressible flow is presented. The interaction of these elements is analyzed using a digital computer. Computations of the loading during transient and sinusoidal pitching motions are in good qualitative agreement with measured loads. The method was used to confirm that large torsional response of helicopter blades detected in flight tests can be attributed to dynamic stall. Author

N72-22006*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HYPERSONIC AND TRANSONIC BUZZ MEASUREMENTS ON THE LOWER PITCH FLAP OF THE M2-F2 LIFTING ENTRY CONFIGURATION
Robert W. Warner and Phillip R. Wilcox Washington May 1972 48 p refs
(NASA-TN-D-6799; A-3790) Avail: NTIS CSCL 01B

Free-oscillation damping measurements at hypersonic and transonic Mach numbers are presented for the lower pitch flap of the M2-F2 reentry vehicle. For the flow and model conditions tested, the damping measurements indicate the absence of hypersonic buzz instability for flap rotation frequencies of 47.3 Hz, 153 Hz, and 360 Hz, the presence of transonic buzz for 47.3 Hz flap, and the absence of transonic buzz for a 115 Hz flap. There are not enough flap damping data for an error estimate based on repeatability, but a partial damping calibration is presented in which an analog computer simulation of random flap response for a known flap damping is fed into the autocorrelation computer and filter combination used for most of the damping measurements. Author

N72-22007*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LIFTING-SURFACE THEORY FOR CALCULATING THE LOADING INDUCED ON A WING BY A FLAP
Wayne A. Johnson Washington May 1972 20 p refs
Prepared Jointly with Army Air Mobility Research and Development Lab., Moffett Field, Calif.
(NASA-TN-D-6798; A-4084) Avail: NTIS CSCL 01A

A method is described for using lifting-surface theory to obtain the pressure distribution on a wing with a trailing-edge flap or control surface. The loading has a logarithmic singularity at the flap edges, which may be determined directly by the method of matched asymptotic expansions. Expressions are given for the singular flap loading for various flap hinge line and side edge geometries, both for steady and unsteady flap deflection. The regular part of the flap loading must be obtained by inverting the lifting-surface-theory integral equation relating the pressure and the downwash on the wing: procedures are described to accomplish this for a general wing and flap geometry. The method is applied to several example wings, and the results are compared with experimental data. Theory and test correlate well. Author

N72-22008*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL INVESTIGATION OF CIRCULAR, FLAT, GROOVED AND PLAIN STEEL DIAPHRAGMS BURSTING INTO A 30.5-CENTIMETER-SQUARE SECTION
Yoshio Yamaki and James R. Rooker Washington May 1972 31 p refs
(NASA-TM-X-2549; L-4645) Avail: NTIS CSCL 20K

Limited data on the bursting of circular, initially flat, grooved and plain steel diaphragms opening into a 30.5-cm-square section are presented in tabular form. In addition, these data were used to determine values of an empirical constant to be used in a design equation for predicting diaphragm bursting pressures and opening times. Author

N72-22009# Virginia Polytechnic Inst., Blacksburg.
NONLINEAR RESONANCES IN THE MOTION OF ROLLING REENTRY BODIES
Ali Hasan Nayfeh and William S. Saric (Sandia Labs., Albuquerque, N. Mex.) Dec. 1971 50 p refs Sponsored by AEC
(SC-RR-710807) Avail: NTIS

The method of multiple scales has been used to analyze the motion of rolling reentry bodies under the influence of nonlinear pitch, damping, and Magnus moments. Each of these moments is assumed to be a cubic function of angle of attack. Three cases have been considered: (1) an axisymmetric body with roll rate near and away from zero, (2) an asymmetric body away from roll resonance, and (3) a slightly asymmetric body near roll resonance. In each case, equations have been derived to characterize the time variation of the amplitudes and phases of the nutation and precession modes. The effects of the moment parameters and the magnitude of the asymmetry on the motion have been investigated. Certain ranges of these parameters have been found to induce instability. Author

N72-22010# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.
CONTROL AND DISTURBANCE TRANSFER FUNCTION OF LONGITUDINAL AIRCRAFT MOTION WITHOUT AUTOMATIC CONTROL
G. Schaenzer 1971 24 p refs In GERMAN; ENGLISH summary Prepared jointly with Bodenseewerk Geraetetechnik
(DLR-Mitt-71-11) Avail: NTIS; DFVLR, Porz: 9 DM

Tables are presented of the coefficients of the control and perturbation transfer functions for longitudinal motion of an uncontrolled aircraft in turbulent air conditions. The coefficients are derived from the linear equations of motion. The coefficients of each transfer function are set out in the tables in implicit form as function of the stability derivatives in such a way that the change of sign of the coefficients, leading to instability and non-minimum phase effects, become visible. The stability derivations, causing instability and non-minimum phase effects, are specially indicated. ESRO

N72-22011# Boeing Co., Philadelphia, Pa. Vertol Div.
DESIGN STUDIES AND MODEL TESTS OF THE STOWED TILT ROTOR CONCEPT. VOLUME 8: SUMMARY OF STRUCTURAL DESIGN CRITERIA AND AERODYNAMIC PREDICTION TECHNIQUES Final Report, Dec. 1970 - Jul. 1971
Robin W. Sandford, Francis J. McHugh, Leon N. Delarm, Edward B. Schagrin, and John P. Magee Oct. 1971 280 p refs
(Contract F33615-69-C-1577)
(AD-736021; D213-1000-8-Vol-8; AFFDL-TR-71-62-Vol-8) Avail: NTIS CSCL 01/3

The report presents a summary of the technical data from four wind tunnel tests on tilt and stowed rotor performance and fully dynamic models. Blade loads, dynamic stability, performance, rotor/wing interactions, and stability and control data are presented. The impact of the tests on stowed rotor aircraft design are discussed and recommendations for further technical and design work are provided. Author (GRA)

N72-22012# Ballistic Research Labs., Aberdeen Proving Ground, Md.
WIND TUNNEL MAGNUS TESTING OF A CANTED FIN OR SELF-ROTATING CONFIGURATION Memorandum Report
A. S. Platou Dec. 1971 19 p ref
(DA Proj. 1T0-61102-A-33D)
(AD-736369; BRL-MR-2143) Avail: NTIS CSCL 20/4

A source of error in the wind tunnel measurement of Magnus forces and moments on a self-rotating configuration has been detected, and means of overcoming the error are presented. The error is due to a normal force interaction brought about by the roll of the angle of attack plane which in turn is due to a small yaw angle of the model at zero angle of attack. The error is not a balance interaction error. The error can completely mask the true Magnus characteristics and can lead the experimenter to wrong conclusions. Although a computed vorrection may be made to existing data, the best method of eliminating the error is to obtain balance readings with and without spin at each angle of attack of interest. Author (GRA)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N72-22013*+ Boeing Co., Renton, Wash. Commercial Airplane Div.
SIMULATOR MODEL SPECIFICATION FOR THE AUGMENTOR WING JET STOL RESEARCH AIRCRAFT
P. C. Rumsey and R. E. Spitzer Dec. 1971 105 p ref
(Contract NAS2-6025)
(NASA-CR-114434; D6-26065TN) Avail: NTIS CSCL 01B

The configuration and simulation studies of a C-8A (De Havilland Buffalo) aircraft are described. The modifications to STOL configuration consisted of augmentor-wing jet flaps, blown and drooped ailerons, and leading edge slats. The total simulator model includes a number of component parts for producing realistic visual, aural, tactile, vestibular, and kinesthetic cues for the pilot to assess the predicted behavior of the real airplane. Author

N72-22014*+ Boeing Co., Renton, Wash. Commercial Airplane Div.
A DESIGN SUPPORT SIMULATION OF THE AUGMENTOR WING JET STOL RESEARCH AIRCRAFT
P. C. Rumsey, R. E. Spitzer, and W. L. B. Glende Jan. 1972 160 p ref
(Contract NAS2-6025)
(NASA-CR-114435; D6-24806-1) Avail: NTIS CSCL 01B

The modification of a C-8A (De Havilland Buffalo) aircraft to a STOL configuration is discussed. The modification consisted of the installation of an augmentor-wing jet flap system. System design requirements were investigated for the lateral and directional flight control systems, the lateral and directional axes stability augmentation systems, the engine and Pegasus nozzle control systems, and the hydraulic systems. Operational techniques for STOL landings, control of engine failures, and pilot techniques for improving engine-out go-around performance were examined. Design changes have been identified to correct deficiencies in areas of the airplane control sytems and to improve the airplane flying qualities. Author

N72-22015*# Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.
SUMMARY AND RECOMMENDATIONS FOR THE NASA/MIT WORKSHOP ON SHORT HAUL AIR TRANSPORT
Robert W. Simpson Oct. 1971 122 p
(Contract NSR-22-009-631)
(NASA-CR-126135; FTL-R-71-4) Avail: NTIS CSCL 15E

The material is summarized that was covered by the MIT/NASA Waterville Valley workshop which dealt with the institutional, socio-economic, operational and technological problems associated with introducing new forms of short haul domestic air transportation. It was found that future air systems hold great potential in satisfying society's needs for a low noise, low landspace, high access, high speed, large network system for public travel over distances between 5 and 500 miles. It is concluded that quiet air systems are necessary for obtaining community approval, and is recommended that extremely high priority be assigned to the development of quiet aircraft for future short haul air systems. F.O.S.

N72-22016# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT: CONTINENTAL AIR LINES, INCORPORATED, BOEING 707-320C, N47330 AND FLOYD FLYING SERVICE, CESSNA 150J, N61011, COMPTON, CALIFORNIA, AUGUST 4, 1971
29 Dec. 1971 14 p
(NTSB-AAR-72-5) Avail: NTIS

An aircraft accident report of a midair collision between a Boeing 707 airliner and a Cessna 150 aircraft is presented. The incident occurred over Compton, California on August 4, 1971. Both aircraft landed safely and injuries occurred only to the two persons in the Cessna aircraft. Cause of the accident was due to atmospheric lighting conditions which reduced the visibility range and blanking of the Cessna pilot's vision by the wing of the smaller aircraft. Author

N72-22017# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT: TRANS WORLD AIRLINES, INCORPORATED, BOEING 707, N6729TW AND AMERICAN AIRLINES, INCORPORATED, BOEING 707, N8432, NEAR PHILIPSBURG, PENNSYLVANIA, 11 JUNE 1971
29 Dec. 1971 16 p
(NTSB-AAR-72-7) Avail: NTIS

A Trans World Airlines (TWA) Boeing 707, N6729TW, and an American Airlines Boeing 707, N84432, narrowly avoided a midair collision at approximately 35,000 feet near Philipsburg, Pennsylvania, on June 11, 1971, while operating within positive control airspace under the control jurisdiction of the New York Air Route Traffic Control Center. As a result of the violent evasive maneuver executed by the captain of the TWA B-707, three passengers and the flight engineer incurred minor injuries, but did not require immediate medical attention. None of the

occupants of the other aircraft, whose crew was unaware of the occurrence until some time later, was injured. There was no damage to either aircraft, both of which proceeded routinely to their respective destinations. The National Transportation Safety Board determines that the probable cause of this incident was the controller's misidentification of the radar target of TW flight 31, N6729TW, due to a transitory diversion of attention to another portion of the radar display. This resulted in inappropriate traffic control actions with respect to the American Airlines aircraxt and placed the two flights on a collision course at the same altitude. Author

N72-22018# Cranfield Inst. of Technology (England). Dept. of Aerodynamics.

THE EFFECT OF LIFT-SYSTEM AIRFLOW ON THE HULL AERODYNAMICS OF HOVERCRAFT

E. J. Andrews Aug. 1971 58 p refs

(Cranfield-Aero-7) Avail: NTIS

An attempt was made to provide a better understanding of the influence of aerodynamic characteristics on the handling qualities of amphibious hovercraft. The following were explored: (1) aerodynamic characteristics of related hovercraft shapes; (2) the effect of cushion efflux on external aerodynamic characteristics; (3) the effects of lift-system airflow and the location of induction ports on the aerodynamic characteristics of hovercraft hulls. It was established that no major effects of consequence exist, yet, certain measures can be taken during the design stages of hulls, skirts and induction ports that will minimize inherent adverse characteristics. Author

N72-22019*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

OPTIMUM PERFORMANCE OF HOVERING ROTORS

J. C. Wu (Georgia Inst. of Tech., Atlanta) and P. M. Goorjian Mar. 1972 54 p

(NASA-TM-X-62138) Avail: NTIS CSCL 01B

A theory for the optimum performance of a rotor hovering out of ground effect is developed. The performance problem is formulated using general momentum theory for an infinitely bladed rotor, and the effect of a finite number of blades is estimated. The analysis takes advantage of the fact that a simple relation exists between the radial distributions of static pressure and angular velocity in the ultimate wake, far downstream of the rotor, since the radial velocity vanishes there. This relation permits the establishment of an optimum performance criterion in terms of the ultimate wake velocities by introducing a small local perturbation of the rotational velocity and requiring the resulting ratio of thrust and power changes to be independent of the radial location of the perturbation. This analysis fully accounts for the changes in static pressure distribution and axial velocity distribution throughout the wake as the result of the local perturbation of the rotational velocity component. Author

N72-22020# National Transportation Safety Board, Washington, D.C.

STUDY OF LESSONS TO BE LEARNED FROM ACCIDENTS ATTRIBUTED TO TURBULENCE

15 Dec. 1971 72 p

(NTSB-AAS-71-1) Avail: NTIS

Turbulence-involved U. S. air carrier accidents occurring from 1964-1969 are presented. Based on the detailed investigation of those accidents, lessons to be learned primarily from the point of view of the meteorologist, the air carrier and the pilot are discussed. Observations are made and conclusions drawn in regard to such factors as the adequacy of CAT (clear air turbulence) versus thunderstorm-associated turbulence forecasts, the use of airborne weather radar as a thunderstorm avoidance tool, airborne weather radar maintenance problems, the requirement for real-time data in the cockpit, CAT detectors, turbulence associated losses, the nuisance problem and information derived from cockpit voice recorders and flight data recorders. Author

N72-22021# National Transportation Safety Board, Washington, D.C.

AIRCRAFT ACCIDENT PRELIMINARY REPORT: MOHAWK AIRLINES, INC., FAIRCHILD HILLER, FH-227B, N7818M, ALBANY, NEW YORK, 3 MARCH 1972

14 Apr. 1972 10 p

(SB-72-23) Avail: NTIS

The aircraft accident involving a Fairchild-Hiller 227B transport with 45 passengers and a crew of 3 which crashed south of the Albany County Airport, New York, on March 3, 1972 is reported. The aircraft was conducting a backcourse instrument landing system approach when the crew reported a problem with the left engine. About 32 seconds later, the crew reported that they were in trouble and would be landing short. The aircraft struck a house near the airport. Author

N72-22022*# Barry Wright Corp., Watertown, Mass.

DESIGN, FABRICATION AND TESTING OF TWO ELECTROHYDRAULIC VIBRATION ISOLATION SYSTEMS FOR HELICOPTER ENVIRONMENTS

Rush E. Allen and Peter C. Calcaterra [1972] 60 p refs

(Contract NAS1-10103)

(NASA-CR-112052) Avail: NTIS CSCL 01B

Two electrohydraulic vibration isolation systems were designed and fabricated to reduce the vertical vibrations transmitted to the XH-51N research helicopter cabin at the blade passage frequency (18 Hz) and its first harmonic (36 Hz). Hydraulic power and electrical control are provided to two separate servoactuators from a common power supply and control electronics package located behind the pilot's seat. One servoactuator is installed between the cabin and fuselage and replaces an existing passive spring. A second servoactuator is mounted between the existing seat and cabin floor. Both servoactuators incorporate a mechanical failsafe design. The control electronics circuitry provides automatic tracking of the blade passage frequency. Results of laboratory, environmental and ground vibration tests employing an XH-51A stripped down helicopter fuselage show that the active cabin isolator reduces the vertical vibrations transmitted from the fuselage attachment point to the cabin attachment point at 18 and 36 Hz (or as an alternative, 6 Hz) by better than 90 percent. Author

N72-22023*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

THREE-TRACK RUNWAY AND TAXIWAY PROFILES MEASURED AT INTERNATIONAL AIRPORTS G AND H

Albert W. Hall Washington Apr. 1972 105 p refs

(NASA-TN-D-6680; L-8189) Avail: NTIS CSCL 01B

Three-track runway and taxiway profiles are presented for use in studies of airplane response to ground roughness. This report presents the tabulated and plotted data for two international airports (designated airports G and H). Author

N72-22024*# Bell Aerospace Co., Buffalo, N.Y.

EVALUATION OF ACTIVE COOLING SYSTEMS FOR A MACH 6 HYPERSONIC TRANSPORT AIRFRAME, PART 2 Final Report

R. G. Helenbrook, W. A. McConarty, and F. M. Anthony Washington NASA Dec. 1971 194 p refs

(Contract NAS1-7468)

(NASA-CR-1917; Rept-7305-902001-Pt-2) Avail: NTIS CSCL 01B

Transpiration and convective cooling concepts are examined for the fuselage and tail surface of a Mach 6 hypersonic transport aircraft. Hydrogen, helium, and water are considered as coolants. Heat shields and radiation barriers are examined to reduce heat flow to the cooled structures. The weight and insulation requirements for the cryogenic fuel tanks are examined so that realistic totals can be estimated for the complete fuselage and tail. Structural temperatures are varied to allow comparison of aluminum alloy, titanium alloy, and superalloy contruction materials. The results of the study are combined with results obtained on the wing structure, obtained in a previous

study, to estimate weights for the complete airframe. The concepts are compared among themselves, and with the uncooled concept on the basis of structural weight, cooling system weight, and coolant weight. Author

N72-22025# Rowland and Co., Haddonfield, N.J.
AIRCRAFT EXTERIOR LIGHTING AND MARKING Final Report, Jan. 1971 - Jan. 1972
George E. Rowland and Carl A. Silver May 1972 110 p refs
(Contract DOT-FA69NA-357)
(FAA-NA-72-29; Rept-72-24) Avail: NTIS

The contemporary state of human factors knowledge concerning aircraft exterior lighting and marking is investigated. Efforts to increase conspicuity in the absence of an unforeseen technological breakthrough, will probably continue to be essentially useless. A simple white-on-top, black-on-bottom paint scheme, which leaves about one-fourth of a metal aircraft bright aluminum to cause specular reflection of sunshine, is recommended as the most likely overall compromise paint design. Author

N72-22026*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
IN-FLIGHT PILOT EVALUATIONS OF THE FLYING QUALITIES OF A FOUR-ENGINE JET TRANSPORT
Euclid C. Holleman and Glenn B. Gilyard Washington May 1972 54 p refs
(NASA-TN-D-6811; H-680) Avail: NTIS CSCL 01B

The flying qualities of the CV-990 jet transport were evaluated over the normal operating flight envelope and in smooth air to provide baseline data for transport airplanes. Pilot ratings of airplane handling characteristics for specific test conditions and configurations from approach to normal cruise were compared with various flying qualities criteria. In general, the CV-990 flying qualities were evaluated as satisfactory, and the evaluations supported transport flying qualities criteria. The Dutch roll damping was rated more satisfactory than was predicted by the flying qualities criteria. The pilots found rudder coordination for the yaw generated during high roll rates very difficult. They preferred to control with roll and pitch controls and to use the yaw damper to provide the required rudder coordination. Author

N72-22027*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUPERSONIC AERODYNAMIC DAMPING AND OSCILLATORY STABILITY IN PITCH AND YAW FROM A MODEL OF A VARIABLE-SWEEP FIGHTER AIRPLANE WITH TWIN VERTICAL TAILS
Robert A. Kilgore and Jerry B. Adcock Washington May 1972 41 p refs
(NASA-TM-X-2555; L-8025) Avail: NTIS CSCL 01B

Wind-tunnel measurements of the aerodynamic damping and oscillatory in pitch and yaw for a 1/22-scale model of a proposed carrier-based variable-sweep fighter airplane have been made by using a small-amplitude forced-oscillation technique. Tests were made with a wing leading-edge sweep angle of 68 deg at angles of attack from about -1.5 deg to 15.6 deg at a Mach number of 1.60 and at angles of attack from about -3 deg to 21 deg at Mach numbers of 2.02 and 2.36. The results of the investigation indicate that the basic configuration has positive damping and positive oscillatory stability in pitch for all test conditions. In yaw, the damping is generally positive except near an angle of attack of 0 deg at a Mach number of 1.60. The oscillatory stability in yaw is positive except at angles of attack above 16 deg at Mach numbers of 2.02 and 2.36. The addition of external stores generally causes increases in both pitch and yaw damping. The oscillatory stability in pitch is reduced throughout the angle-of-attack range by the addition of the external stores. The effect of adding stores on the oscillatory stability in yaw is a function of angle of attack and Mach number. The effect of changing horizontal-tail incidence on the pitch parameters is also very dependent on angle of attack and Mach number. Author

N72-22028# National Transportation Safety Board, Washington, D.C.
SPECIAL STUDY: CARBURETOR ICE IN GENERAL AVIATION
19 Jan. 1972 13 p
(NTSB-AAS-72-1) Avail: NTIS

The carburetor ice to which reciprocating engine installations are susceptible was a probable cause or factor in 360 general aviation accidents over a recent 5-year period. In these accidents there were 40 fatalities and 160 people injured out of a total of 636 persons aboard. Such losses as these can be reduced through the exercise of greater pilot awareness and vigilance. Included in this report are descriptions of conditions conducive to carburetor icing, modes of carburetor icing, and procedures for circumventing power loss due to carburetor ice. It is believed that reduction of carburetor icing accidents is attainable through further pilot education, and that the most effective means of accomplishing this would be for the Federal Aviation Administration to send a carburetor ice advisory to each of its registered pilots. Author

N72-22029# Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany).
OUTSTANDING PROBLEMS OF AIRCRAFT AERODYNAMICS [OFFENE PROBLEME DER FLUGZEUG-AERODYNAMIK]
J. Barche 1971 34 p refs In GERMAN Presented at the 4th DGLR Annual Meeting, Baden-Baden, West Ger., 11-13 Oct. 1971
Avail: NTIS

Some of the problems which have been met in the development of aircraft projects are analyzed. The problem is limited to subsonic and transonic transport and military aircraft. ESRO

N72-22030# United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.
INVESTIGATION OF THE STABILATOR ON THE S-67 AIRCRAFT Final Report
Thaddeus T. Kaplita Oct. 1971 110 p refs
(Contract DAAJ02-71-C-0010; DA Proj. 1F1-63204-D-157)
(AD-735766; SER-67006; USAAMRDL-TR-71-55) Avail: NTIS CSCL 01/3

A flight test and simulation investigation of the S-67 stabilator was conducted. The S-67 stabilator, an all-movable, in-flight-trimmable horizontal stabilizer, is coupled to the longitudinal cyclic control in forward flight and may be uncoupled to free-float in hover. The flight tests included hover, transitions, low- and high-speed flight, autorotation, and stabilator bias actuator hardovers. In the simulation study, stabilator design was varied to establish trends due to design changes. The existing stabilator design will provide the aircraft with acceptable trim and static stability for the full G. W. and C. G. envelope. In-flight trimmability provides control of fuselage attitude independent of the rotor. Author (GRA)

N72-22031# Winzen Research, Inc., Minneapolis, Minn.
DEVELOPMENT OF A LIGHTWEIGHT BALLOON TO CARRY A PAYLOAD OF 50 POUNDS AT AN ALTITUDE OF 160,000 FEET Final Report, 15 Apr. - 30 Jul. 1971
Jean R. Nelson and Peter J. Osborne 9 Aug. 1971 8 p
(Contract F19628-71-C-0166)
(AD-735292; AFCRL-71-0479) Avail: NTIS CSCL 01/3

The contract was for the development of two lightweight balloons to carry a load of 50 pounds each at an altitude of 160,000 feet. The final balloon design was approved by AFCRL after some initial modifications. Included in the design was an auxiliary 'stub' duct which will be used for a quick, controlled descent of the balloon. The StratoFilm balloon gores were sealed with a newly-designed precision band-sealer, specially developed to provide a high quality seal for very thin film materials. In addition, a 40 foot long tube using the same material as used for the balloon was made for each balloon. The balloons were

fabricated, boxed with their respective tubes, and shipped on 30 July 1971 to Holloman AFB, New Mexico. Author (GRA)

N72-22032# Naval Air Development Center, Johnsville, Pa. Aero Mechanics Dept.
AIR SKIMMER PROGRAM (X-28A) Final Report
Nicholas E. Dapuzzo 30 Dec. 1971 19 p refs
(AD-736187; NADC-AM-7140) Avail: NTIS CSCL 01/3

The objective of the task was to explore the potential usefulness of a small, single-seat seaplane for civil police patrol duties in Southeast Asia. Investigation of existing private and sport aircraft and subsequent flight evaluation testing of one such vehicle indicate that the Osprey 1, Navy designation X-28A, may afford a good baseline configuration which with certain refinements could provide a vehicle suitable for operational use. GRA

N72-22033# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
REDUCTION IN FLUTTER INSTABILITY OF AN ELASTIC BEAM WITH THE RIGID EMPENNAGE IN SUPERSONIC FLOW
I. T. Selezov and G. T. Kovbasa 18 Nov. 1971 14 p refs Transl. into ENGLISH from Gidroaeromekhan. i Teoriya Uprugosti (USSR), no. 9, 1970 p 29-34
(AD-736487; FTD-MT-24-97-71) Avail: NTIS CSCL 01/3

The possibility of the expansion of the region of dynamic elastic stability of a finned beam streamlined by a supersonic gas flow is investigated. In order to do this a system of automatic control, which consists of the object of control, measuring elements and actuators, is used. GRA

N72-22034# RAND Corp., Santa Monica, Calif.
AIRFRAME STRUCTURAL MATERIALS FOR DRONE APPLICATIONS
Donald F. Adams Jul. 1971 49 p refs
(Contract DAHC15-67-C-0141; ARPA Order 189)
(AD-736616; R-581/4-ARPA) Avail: NTIS CSCL 01/3

A comparison was made of performance, weight, and cost characteristics of a wide range of structural materials for aircraft. Materials ranging from polyester-impregnated paper and wood to titanium and the high-performance reinforced composites are compared with conventional aluminum alloys for subsonic vehicles. At high supersonic speeds, aerodynamic heating dictates use of high-temperature materials such as coated columbium, molybdenum, and TD nickel alloys. Fuselage, wing, tail, and engine nacelle components are individually considered for 5 representative subsonic and 3 supersonic configurations; 9 different material combinations are evaluated for the subsonic and 8 for the supersonic vehicles. Author (GRA)

N72-22035# Boeing Co., Philadelphia, Pa. Vertol Div.
DESIGN STUDIES AND MODEL TESTS OF THE STOWED TILT ROTOR CONCEPT. VOLUME 9: VALUE ENGINEERING REPORT Final Report
Jaan Liiva and H. J. Rose Oct. 1971 66 p
(Contract F33615-69-C-1577)
(AD-736022; D213-10000-9-Vol-9; AFFDL-TR-71-62-Vol-9) Avail: NTIS CSCL 01/3

The report describes and compares the technical and cost issues of flush and edgewise folding of the rotor blades for a stowed tilt rotor aircraft. Four different folding actuation schemes are presented. A cost saving recommendation is also made for the hub costing. Author (GRA)

N72-22036# United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.
GROUND TEST EVALUATION OF THE SIKORSKY ACTIVE TRANSMISSION ISOLATION SYSTEM Final Technical Report, 1 Jul. 1969 - 31 Oct. 1970
Paul W. VonHardenberg and Paul B. Saltanis Sep. 1971 129 p refs
(Contract DAAJ02-69-C-0101; DA Proj. 1F1-62204-A-146)
(AD-736347; SER-50682; USAAMRDL-TR-71-38) Avail: NTIS CSCL 13/9

Active isolation of a full-scale CH-53A helicopter fuselage was successfully demonstrated during hangar shake tests. Overall reductions of approximately 70 percent in fuselage response to main rotor 6p excitations were achieved, while sensitivity to 1p in-plane excitation was increased by only 13 percent. These isolation levels were achieved with a design constrained by the geometry of the CH-53A fuselage. Analytical studies indicate that further reductions in vibratory response could be achieved if fuselage and isolation system design were integrated. Author (GRA)

N72-22037# Systems Research Labs., Inc., Dayton, Ohio.
DEVELOPMENT OF AN RF-4C REFUELING TRAINING PROGRAM FROM COMPUTER-BASED SYSTEMS DATA Final Report
Horace H. Valverde, Charles F. Hicks, and Ned H. Kearns Brooks AFB Texas AFHRL Jun. 1971 109 p refs
(AF Proj. 1710)
(AD-736409; AFHRL-TR-71-25) Avail: NTIS CSCL 05/9

The report describes the development of a systems approach to RF-4C air refueling training. The primary objective of the effort was to develop an instructional plan, or blueprint, using a format which facilitates the utilization of existing computer-based task data by training personnel. The training plan was developed for use by Tactical Air Reconnaissance Center instructor personnel in training RF-4C aircrews to effectively perform KC-135 air refueling requirements. Author (GRA)

N72-22038# Honeywell, Inc., St. Paul, Minn. Systems and Research Center.
DISPLAY AND RELATED SYSTEM REQUIREMENTS FOR IFR STEEP APPROACH Final Report, Nov. 1967 - Aug. 1971
James D. Wolf Jan. 1972 179 p refs
(Contract N00014-68-C-0191; NR Proj. 213-061)
(AD-736247; JANAIR-711106; Rept-12571-FR4) Avail: NTIS CSCL 01/4

The objective was to establish display information and subsystem requirements for manually controlled steep-angle approach and landing under IFR flight conditions with vertical-lift aircraft. Investigations were conducted as a series of iterative analyses and the real-time man-in-the-loop simulations to evaluate selected display formats, themselves, as well as the effects which relevant system and environmental variables have upon piloting task performance. Alternative display formats were initially tested under idealized flight conditions. The testing of selected formats was then continued in a series of simulation studies in which system and environmental characteristics were systematically introduced to determine their individual and interactive effects upon piloting performance. Author (GRA)

N72-22039# RAND Corp., Santa Monica, Calif.
A STUDY OF IRAN EFFECTIVENESS FOR THE F-106
Theodore S. Donaldson Oct. 1971 34 p refs
(Contract F44620-67-C-0045)
(AD-736410; R-755-PR) Avail: NTIS CSCL 01/3

The report describes an investigation of the effect of IRAN (inspect and repair as necessary) depot maintenance on the F-106 aircraft. This effect is measured in terms of aircraft performance (using ADCM 66-28 data) before and after IRAN, and in terms of interval length between successive IRANs. Results indicate that aircraft are not in a degraded condition prior to IRAN, and are not improved by IRAN. Further, aircraft with long intervals (calendar time or flying hours) between successive IRANs are not in worse condition than those with short intervals. Author (GRA)

N72-22040# Army Aeromedical Research Lab., Fort Rucker, Ala.
DYNAMIC AND CRASHWORTHY EVALUATION OF THE UH-1B, C, D, H, MEDICAL ATTENDANT'S SEAT
Errol B. Barber, Stanley C. Knapp, G. E. Tornquist, S. P. Desjardins, and Felix T. Aguilar Jan. 1972 97 p
(AD-737197; USAARL-72-07) Avail: NTIS CSCL 01/3

The challenge was to evaluate the crashworthiness of the UH-1 medical attendant's seat and investigate the feasibility of modifications to improve the seat and its restraint system. This report is a record of USAARL'S involvement, from researching the background to achieve a proper direction for study, through accident statistics, stress analysis, dynamic test program, reduction of data, interpretation, conclusion and, finally, feasible recommendations. The seat was found to be completely noncrashworthy and a direct contributor of serious injuries to its occupants, mostly to the upper torso and head because of poor occupant restraint. Its construction and manufacture did not meet all of the design criteria of military seat specifications. The dynamic tests of the seat demonstrated that with the addition of an inertia reel, shoulder harness, and attachment of the lap belt to the floor a seat occupant could be satisfactorily restrained despite serious seat failure during a crash. The proposed modifications in kit form will provide the seats occupant with the greatest increase in safety and retention, should crash occur, for the lowest dollar investment and down time required for its installation. Author (GRA)

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N72-22041* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLID STATE MATRICES Patent
Walter A. Hasbach and John V. Goldsmith, inventors (to NASA) Issued 2 Nov. 1971 6 p Filed 15 Nov. 1968 Sponsored by NASA
(NASA-Case-NPO-10591; US-Patent-3,616,528; US-Patent-Appl-SN-776185; US-Patent-Class-29-572) Avail: US Patent Office CSCL 10A

An electrically connected matrix of discrete solar cell blanks is described. Electrode contact receiving areas are provided on the light-sensitive surface of each blank and discrete, continuous conducting layers are directly attached to the contact areas. These extend between at least two of the blanks to form integral electrode contacts on, and interconnections between them. The cell blanks are disposed in separated, adjacent, side-by-side arrangements with their light-sensitive faces lying in the same plane. Bridges for supporting the interconnection are placed in the separations. Portions of the blanks are masked and metal is deposited through the mask onto the bridges and surfaces to form integral electrode contacts on, and interconnections between, the separated blanks. Official Gazette of the U.S. Patent Office

N72-22042* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLAR CELL PANELS WITH LIGHT TRANSMITTING PLATE Patent
John V. Goldsmith and Geza P. Rolik, inventors (to NASA) Issued 26 Oct. 1971 5 p Filed 28 Jan. 1970 Supersedes N70-25867 (08 - 12, p 2147) Sponsored by NASA
(NASA-Case-NPO-10747; US-Patent-3,615,853; US-Patent-Appl-SN-6616; US-Patent-Class-136-89) Avail: US Patent Office CSCL 10B

A solar cell panel with a cover plate defines a number of apertures with light-reflective surfaces. The shapes of the apertures and the spacings between them are chosen to vary the illumination level of the cells, as a function of the degree of inclination of the plate with respect to the normal light direction. Official Gazette of the U.S. Patent Office

N72-22043*# Philco-Ford Corp., Palo Alto, Calif. Western Development Labs. Div.
ENGINEERING EXPERIMENTAL PROGRAM ON THE EFFECTS OF NEAR-SPACE RADIATION ON LITHIUM DOPED SOLAR CELLS Final Report
10 Nov. 1971 109 p refs
(Contract NAS7-100; JPL-952585)
(NASA-CR-126151; WDL-TR4725) Avail: NTIS CSCL 10A

The results of an experimental evaluation of the real-time degradation characteristics of lithium-diffused silicon solar cells are reported. A strontium-90 radioisotope was used for simulation of a typical earth-orbital electron environment. The experiment was performed in an ion pump vacuum chamber with samples maintained at -50, +20, +50, and +80 C. Samples were illuminated during the 6-month exposure run with solar cell 1-5 characteristics measured periodically in situ. This 6-month exposure corresponded to a 1 MeV equivalent fluence of approximately 10 to the 14th power electrons/sq cm. Several types of lithium cells were irradiatied and compared directly with conventional N/P cells. The best lithium cells compared favorably with N/P cells, particularly at the higher test temperatures. With a slight improvement of initial performance characteristics, lithium cells appear feasible xor 5 to 10 year missions at synchronous altitude. Based on the reported results and those of other irradiation experiments, lithium cells would appear to be superior to N/P cells in proton-dominated earth-orbital environments. Another important conclusion of the effort was that illuminated/loaded cells degrade more rapidly than do dark/unloaded cells. The irradiation experiment provided data of high quality with a high degree of confidence because of the experimental and statistical analysis techniques utilized. Author

N72-22044*# Globe-Union, Inc., El Monte, Calif. Centralab Semiconductor Div.
OPTIMIZED SILICON SOLAR CELLS FOR SPACE EXPLORATION POWER SYSTEMS Final Report
Peter A. Iles 30 Nov. 1971 101 p
(Contract JPL-952865)
(NASA-CR-126216) Avail: NTIS CSCL 10A

A program is described aimed at designing and fabricating improved silicon solar cells for a range of missions extending from 0.1 to 15 astronomical units (Mercury to Jupiter). For missions lying inside Earth radius (Mercury, Venus) the major cell property required was very low series resistance, allowing high curve fill factor to be maintained at the higher intensities. For the Mercury mission, the temperature of the cell had to be kept low. This was achieved by reflecting more of the incident sunlight by use of large area front contacts. For the outer missions (Mars, the Asteroid belts and Jupiter) the formation of a Schottky barrier at the back contact had to be avoided (by use of a P+ layer under the back contact) and the excess leakage current of the PN junction had to be reduced. Optimum grid patterns were also derived and used for these missions. Author

N72-22045*# Eagle-Picher Co., Joplin, Mo. Couples Dept.
STUDY OF PROCESS VARIABLES ASSOCIATED WITH MANUFACTURING HERMETICALLY-SEALED NICKEL-CADMIUM CELLS Quarterly Report, Nov. 1970 - Feb. 1971
Lee Miller, Donald J. Doan, and Earl S. Carr Sep. 1971 153 p refs
(Contract NAS5-21159)
(NASA-CR-126147; QR-4) Avail: NTIS CSCL 10A

A program to determine and study the critical process variables associated with the manufacture of aerospace, hermetically-sealed, nickel-cadmium cells is described. The determination and study of the process variables associated with the positive and negative plaque impregnation/polarization process are emphasized. The experimental data resulting from the implementation of fractional factorial design experiments are

analyzed by means of a linear multiple regression analysis technique. This analysis premits the selection of preferred levels for certain process variables to achieve desirable impregnated plaque characteristics. Author

N72-22046*# Tyco Labs., Inc., Waltham, Mass.
NiCd BATTERY ELECTRODES, C-150 Quarterly Report
G. Holleck Nov. 1971 31 p refs Prepared for JPL
(Contracts NAS7-100; JPL-953185)
(NASA-CR-126143; QR-1) Avail: NTIS CSCL 10C

A research program to develop and evaluate electrodes for a nongassing negative limited nickel-cadmium cell is described. The concept of the negative limited cell and its implications on electrode structure are discussed. The key element is the development of a cadmium electrode with high hydrogen overvoltage. For this, Teflon-bonded Cd electrodes and silver-sinter based Gc electrodes were manufactured and in preliminary experiments their physical and electrochemical characteristics were evaluated. Hydrogen evolution on cadmium was found to occur approximately 100 mV more cathodic than on silver. Both electrode structures exhibit a fairly sharp potential rise at the end of the charging cycle and the advent of gas evolution occurs at potentials between -1.2 and -1.3 V versus a Hg/HgO reference electrode. These results are compared with conventional Ni-sinter based Cd electrodes. Author

N72-22047*# Naval Ammunition Depot, Crane, Ind. Quality Evaluation and Engineering Lab. Dept.
EVALUATION PROGRAM FOR SECONDARY SPACECRAFT CELLS: ACCEPTANCE TEST OF MCDONNELL-DOUGLAS, ASTROPOWER DIVISION, 40.0 AMPERE HOUR SILVER-ZINC CELLS
J. D. Harkness 26 Nov. 1971 26 p
(NASA Order W-12397)
(NASA-CR-126130; QEEL/C-71-436) Avail: NTIS CSCL 10C

The development of an inorganic separator material for use in construction of 40 ampere-hour silver zinc cells is discussed. Acceptance tests were conducted to determine real quality, physical defevts and ampere-hour capacity. All acceptance tests were performed at an ambient temperature of 23 to 27 C at existing relative humidity and atmospheric pressure. Of the 63 cells tested, only one failed to meet the equipment specifications. Author

N72-22048*# ESB, Inc., Yardley, Pa. Exide Missile and Electronics Div.
IMPROVED STORAGE BATTERY Patent Application
Richard S. Bogner and Charles D. Farris, inventors (to NASA) Filed 22 Feb. 1972 16 p Prepared for JPL
(Contracts NAS7-100; JPL-952472)
(NASA-Case-NPO-10720-1; US-Patent-Appl-SN-228163) Avail: NTIS CSCL 10C

An electric energy storage battery with wedge shaped contour plates is described. The plates are fabricated by applying appropriate compositions of silver and zinc to grids formed of metallic silver and are separated by semipermeable membranes. The purpose of the wedge shape contour is to reduce the debilitating effects on current density which results from shape-change phenomenon. NASA

N72-22049# Scientific Research Inst. of Electro-Physical Apparatus, Leningrad (USSR).
POWER PULSE TRANSFORMER
O. S. Bogdanov, Yu. P. Vakhrushin, V. G. Zhitenev, N. I. Kolesov, and A. V. Orlov 1970 12 p refs In RUSSIAN; ENGLISH summary
(NP-19092) Avail: AEC Depository Libraries

The operation and construction of a powerful pulse transformer, designed for operation in the range of 50 to 500 nsec, are described. A description of the transformer mock-up is given, and results of its testing are presented, which show that the transformer of this type provides good voltage pulse transfer and is characterized by reliable operation. It is recommended to be used in the power supply of the powerful electron gun of the LIA-30/250 accelerator (linear induction accelerator). Author (NSA)

N72-22050# Calvin Coll., Grand Rapids, Mich. Dept. of Chemistry.
BATTERY ZINC ELECTRODE KINETICS INVESTIGATION Annual Report, 15 Dec. 1970 - 15 Dec. 1971
T. P. Dirkse 15 Dec. 1971 36 p refs
(Contract F33615-70-C-1022; AF Proj. 3145)
(AD-736460; AFAPL-TR-71-96; AR-2) Avail: NTIS CSCL 07/4

Batteries using a zinc anode and an alkaline electrolyte offer much promise in terms of desirable energy density factors. However, sometimes when the electrode is charged, the zinc often deposits in the form of dendrites which may form metallic bridges between plates and lead to internal shorting of the cell. In order to gain an understanding of the kinetics of this problem, the exchange current densities of the zinc electrode in KOH solutions were measured over a temperature range of -33 to -55 C in 1 to 14 molar KOH. Galvanostatic, double impulse, and potentiostatic methods were used. A current inversion appears to be related to the concentration of unbound water in the electrolyte. This matter is discussed in connection with measurements made in solutions of controlled ionic strength. GRA

N72-22209*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ANALYSIS OF EFFECTS OF SHADOWED AND OPEN SOLAR CELLS ON OWS SOLAR CELL ARRAY PERFORMANCE
J. L. Miller *In its* Res. Achievements Rev., Vol. 4, Report no. 4 Feb. 1972 p 13-27 refs (See N72-22207 13-09)
Avail: NTIS CSCL 10A

N72-22210*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE USE OF THE SOLAR CELL DARK CHARACTERISTIC FOR CHECKOUT OF LARGE AREA SOLAR ARRAYS
W. L. Crabtree *In its* Res. Achievements Rev., Vol Report no. 4 Feb. 1972 p 29-35 (See N72-22207 13-09)
Avail: NTIS CSCL 10A

N72-22211*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
NICKEL-CADMIUM BATTERY AND CELL INVESTIGATION FOR APOLLO TELESCOPE MOUNT (ATM) APPLICATIONS
L. E. Paschal *In its* Res. Achievements Rev., Vol. 4, Report no. 4 Feb. 1972 p 37-58 ref (See N72-22207 13-09)
Avail: NTIS CSCL 10C

N72-22214*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LARGE AREA LUNAR SURFACE SOLAR ARRAY
J. L. Miller *In its* Res. Achievements Rev., Vol. 4, Report no. 4 Feb. 1972 p 67-76 refs (See N72-22207 13-09)
Avail: NTIS CSCL 10A

N72-22216*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
INCREASED HYDROX FUEL CELL PERFORMANCE
John R. Morgan *In its* Res. Achievements Rev., Vol. 4, Report no. 4 Feb. 1972 p 97-101 (See N72-22207 13-09)
Avail: NTIS CSCL 10A

N72-22279*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ENVIRONMENTAL SIMULATION TESTING OF SOLAR CELL

CONTAMINATION BY HYDRAZINE
W. Walding Moore, Jr. *In its* Space Simulation 1972 p 461-468 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 10A

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N72-22051*# National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 99
Feb. 1972 109 p refs
(NASA-SP-7011(99)) Avail: NTIS CSCL 06C

Subject coverage concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Each entry consists of a standard citation accompanied by its abstract. Author

N72-22052*+ National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 100)
Mar. 1972 105 p refs
(NASA-SP-7011(100)) Avail: NTIS CSCL 06E

Subject coverage concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the earth's atmosphere or in interplanetary space. Reference describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Each entry consists of a standard citation accompanied by its abstract. Author

N72-22053# Joint Publications Research Service, Arlington, Va.
BIOLOGICAL EFFECT OF EXTREME ENVIRONMENTAL FACTORS
6 Mar. 1972 167 p refs Transl. into ENGLISH from Arkh. Anat., Gistol. Embriol. (Leningrad), v. 61, no. 11, Nov. 1971
(JPRS-55341) Avail: NTIS

Experimental research on changes and effects of extreme environments on body systems is reported. Detailed summaries are given for the effects on nerve cells, liver functions, spleen functions, and various blood circulation systems. Other related material on muscle systems and joints is included. For individual titles, see N72-22054 through N72-22072.

N72-22054# Joint Publications Research Service, Arlington, Va.
SOME OF THE RESULTS AND PROSPECTS IN SPACE ANATOMY OF THE VASCULAR SYSTEM
M. G. Prives *In its* Biol. Effect of Extreme Environ. Factors 6 Mar. 1972 p 1-16 refs (See N72-22053 13-04)
Avail: NTIS

An investigation of the effects of high altitude and space flight stress factors on the vascular system is discussed. Results show: (1) The vascular bed decreases, and all its elements change (arteries, veins, capillaries, and lymphotic vessels); these elements become tortuous, irregularly constricted or dilated. (2) The permeability of the vascular wall increases. (3) There is slower formation of blood and lymph collaterals, which is indicative of weakening of the regeneration process. In the future it was recommended that patterns of separate hypokinesia and hypodynamia effects on vessels and all organs be determined as well as the difference between generalized and partial hypokinesia. It was also recommended that methods be developed for preventing the adverse consequences of limited mobility and control. The combined effects of these stress factors are investigated. Author

N72-22055# Joint Publications Research Service, Arlington, Va.
THE EFFECT OF G FORCES ON THE MICROCIRCULATORY SYSTEM
V. V. Kupriyanov and V. G. Petrukhin *In its* Biol. Effect of Extreme Environ. Factors 6 Mar. 1972 p 17-33 refs (See N72-22053 13-04)
Avail: NTIS

The effects of gravitational stress, of varying intensity and direction, on the microcirculatory system of dogs and albino rats are investigated. Major efforts were made to: (1) determine and analyze the dynamics of morphological changes in the microcirculatory bed and its components; (2) investigate the condition of organic tissular structures under the same gravitational conditions; and (3) determine the significance of conditioning to increase the range of tolerable accelerations and prevent signs of morphological disorganization in the vascular system and the parenchyma of organs. Author

N72-22056# Joint Publications Research Service, Arlington, Va.
THE CONDITION OF NEURONS IN THE AUTONOMOUS NERVOUS SYSTEM GANGLIA FOLLOWING EXPOSURE TO G FORCES
Ye. A. Dyskin and L. P. Tikhonova *In its* Biol. Effect of Extreme Environ. Factors 24 Mar. 1972 p 34-41 refs (See N72-22053 13-04)
Avail: NTIS

The effects of hypergravitation on morphological changes in the components of the autonomous nervous system are investigated. Special attention was given to the neurons and ganglia. Results indicate that the nodose ganglion of the vagus shows swelling of neurons, pericellular and perinuclear edema, irregular distribution of chromatophilic substance, and irregular shaped or no nucleus. It was also noted that vacuolization occurred in some of the nerve cells. In the ganglia of the splanchnic plexus, redistribution of the chromatophil substance occurred, some vacuolization is present, the nucleus is markedly enlarged, and in some cases completely dissolved. These ganglia show less changes than the others observed. The most severe morphological reaction was observed in the ganglia of the pelvic plexus. Almost all of the nerve cells of this region undergo vacuolization, edema, neuron wrinkles, and neuronophagia.
E.H.W.

N72-22057# Joint Publications Research Service, Arlington, Va.
THE EFFECT OF TRANSVERSE G FORCES ON ATRIAL NERVE CELLS (EXPERIMENTAL MORPHOLOGICAL INVESTIGATION)
S. S. Mikhaylov, V. M. Klebanov, and S. I. Yevloyev *In its* Biol. Effect of Extreme Environ. Factors 6 Mar. 1972 p 42-54 refs (See N72-22053 13-04)
Avail: NTIS

The morphological changes in the atria nerve cells under the influence of transverse gravitational stress are investigated. Results show that the heart neurons react more to acceleration than other nerve components. Experimental results also indicate that the atrial nerve system has a certain tolerance to gravitational stress. However, the neurons show reversible reactions at small accelerations, but return to normal in a short period after exposure. Under multiple accelerations some neurons perish. These changes can be reversed after one or two months due to compensatory changes. E.H.W.

N72-22058# Joint Publications Research Service, Arlington, Va.
THE EFFECT OF TRANSVERSE G FORCES ON NERVE ELEMENTS OF THE RAT'S PHARYNGEAL AND ESOPHAGEAL NERVE ELEMENTS FOLLOWING PRELIMINARY EXPOSURE TO A CONSTANT MAGNETIC FIELD
V. P. Golev and G. V. Chepelenko *In its* Biol. Effect of Extreme Environ. Factors 6 Mar. 1972 p 55-58 refs (See N72-22053 13-04)
Avail: NTIS

The nature of morphological changes in the intramural nerves of the pharynx and esophagus was investigated on 30 rats with single and fractional exposure to transverse accelerations lasting 5 to 10 minutes. The animals were rotated in a special centrifuge container with accelerations up to 12 g. Experimental animals were first exposed for one hour to a constant magnetic field with a force of up to 1000 H. Some rats were exposed once to the combined effect of the physical factors. Results show that after the second day, under magnetic field and transverse accelerations, 38.2% of the neurons were hyperargyrophilic. In addition, there were changes in quantitative indices of ratio between argyrophilic and argyophobic neurons. It was also determined that changes occur in relation to force, duration, and prior excitation of the nervous system. Author

N72-22059# Joint Publications Research Service, Arlington, Va.
CHANGES IN TROPHIC FUNCTIONS OF THE EMBRYONIC LIVER UNDER THE INFLUENCE OF TRANSVERSE G FORCES (PLUS G SUB x)
S. K. Konshina, V. I. Stepantsov, and A. V. Yeremin *In its* Biol. Effect of Extreme Environ. Factors 6 Mar. 1972 p 59-65 refs (See N72-22053 13-04)
Avail: NTIS

An experimental investigation of the effects of transverse acceleration on the trophic function of the liver is presented. Control and experimental pregnant mice, at varying stages of their pregnancy, were used for the study. Particular attention was given to the glycogen synthesizing functions, the process of replenishment of the glycogen content after exposure, and the time related parameters of the replenishment process. Histochemical examination of the control group revealed large and small clumps of glycogen in all lobes of the liver. The experimental group revealed that the hepatic vessels were dilated, plethoric, most hepatocyte nuclei were enlarged, and the glycogen decreased. In the control embryos, there were moderate amounts of glycogen present as compared to the adult specimens. In experimental embryos, very high or high glycogen content was observed in all hepatic lobules. It was concluded that increased glycogen breakdown in the mother is associated with increased glycogensis in the embryo liver, thus insuring life and normal liver function of developing progeny. E.H.W.

N72-22060# Joint Publications Research Service, Arlington, Va.
THE EFFECT OF CHEST-BACK G FORCES ON TELENCEPHALIC VESSELS
N. I. Zotova *In its* Biol. Effect of Extreme Environ. Factors 6 Mar. 1972 p 66-71 refs (See N72-22053 13-04)
Avail: NTIS

The influence of chest-back gravitational stress on morphological changes in the telencephalic vessels is examined. Male rabbits were subjected to constant gravitational forces lasting from a few seconds to several minutes. Experimental results show that such forces lead to constriction of the arterial and dilation of the venous part of the brain's vascular bed. During brief exposure some of the arteries were constricted. Most arteries either did not change in diameter or became larger. Under maximum tolerable and intolerable forces, more severe changes in the vessels were noted. It was concluded that the degree to which changes take place depend upon the length and magnitude of force. E.H.W.

N72-22061# Joint Publications Research Service, Arlington, Va.
THE EFFECT OF BACK-CHEST G FORCES ON METENCEPHALIC AND MESENCEPHALIC BLOOD VESSELS
I. N. Preobrazhenskaya *In its* Biol. Effect of Extreme Environ. Factors 6 Mar. 1972 p 72-77 refs (See N72-22053 13-04)
Avail: NTIS

The changes in blood vessel structure of the medulla, pons, and mesencephalon of rabbits exposed to dorsoventral gravitational forces are demonstrated. The rabbits were subjected to a single tolerable force of 8 units for 3 to 10 minutes. After 3 minutes results show negligible constriction; no changes occurred in the veins. Ten minutes exposure results show considerable artery and capillary constrictions. A second series of tests using 8 to 10 units for 30 minutes revealed severely constricted arteries, tortus and dilated veins, and changes in the diameter of the medulla and pons veins. Dilations were also present in these veins. E.H.W.

N72-22062# Joint Publications Research Service, Arlington, Va.
THE EFFECT OF ACCELERATOR TRAINING ON THE RABBIT'S RETINAL VESSELS
L. I. Savinova *In its* Biol. Effect of Extreme Environ. Factors 6 Mar. 1972 p 78-84 refs (See N72-22053 13-04)
Avail: NTIS

The effect of repeated exposure to gravitational stress, for training purposes, on the retinal vessels of rabbits is examined. Efforts were made to determine improved efficiency, if any, in the physiological regulatory mechanism as a result of training, vascular architectonic changes, signs of stasis, and presence of adequate arterial tonus. Results show that in trained rabbits some retinal vessels were changed, some had ruptured, and the primary arteries were not changed or only sightly changed. In untrained rabbits considerable changes occurred in all retinal vessels. As compared to untrained rabbits, trained rabbits tolerated the gravitational stress for a longer period of time and survived where the untrained died. It was concluded that rabbits can be conditioned to tolerate accelerations, and that tolerance depends upon the individual reactions of each animal. E.H.W.

N72-22063# Joint Publications Research Service, Arlington, Va.
THE EFFECT OF ACCELERATOR TRAINING ON SPLENIC RETICULAR TISSUE
S. G. Guseynova *In its* Biol. Effect of Extreme Environ. Factors 6 Mar. 1972 p 85-89 refs (See N72-22053 13-04)
Avail: NTIS

The reticular base of the spleen, following exposure to prolonged gravitational stress for training purposes, is investigated. Male rats were used for the study. Autopsy results show dimensional reductions in the spleen after exposure. Other conclusions indicate: (1) The reticular spleen tissue changes depend on the magnitude, direction, and duration of gravitational exposure. (2) Under longitudinal accelerations architectonic reticular tissue increased in network density, and in new formation and tortuosity of fibers with degenerative areas. (3) Under transverse accelerations the architectonics do not differ markedly from normal. (4) Training increases resistance of the tissues to gravitational stress. E.H.W.

N72-22064# Joint Publications Research Service, Arlington, Va.
CHANGES IN SKELETAL MUSCLES ASSOCIATED WITH INACTIVITY
G. S. Katinas and A. N. Potapov *In its* Biol. Effect of Extreme Environ. Factors 6 Mar. 1972 p 90-99 refs (See N72-22053 13-04)
Avail: NTIS

Experiments, under simulated space flight, were made to determine the effects of inactivity on skeletal muscles. The tests were made on male mongrel albino rats. Some of the animals limbs were amputated. Determinations were made of body weight, body weight after skin removal, subcutaneous cellular tissue weight, weight of internal organs, and muscular weight. Results show: (1) Slow weight gain occurs during inactivity. (2) Some muscle retardation was present in all muscles. (3) Muscle weight varies according to test duration. In the amputated animals muscle weight and muscle size increased on the amputated side. It was concluded that muscular weight and size are determined by biomechanical conditions. E.H.W.

N72-22065# Joint Publications Research Service, Arlington, Va.
STRUCTURAL AND CYTOCHEMICAL CHANGES IN THE RAT'S SKELETAL MUSCLES ASSOCIATED WITH RESTRICTED MOBILITY
V. V. Portugalov, Ye. I. Ilina-Kakuyeva, V. I. Starostin, K. R. Rokhlenko, and Z. F. Savik *In its* Biol. Effect of Extreme Environ. Factors 6 Mar. 1972 p 100-111 refs (See N72-22053 13-04)
Avail: NTIS

An investigation was made to determine the nature of structural and cytochemical changes in some skeletal muscles of the hind legs as related to different durations of hypokinesia and hypodynamia. Mongrel male rats were used as subjects. The rats maintained under hypodynamic and hypokinetic conditions show marked delay in weight gain as compared to the control group. These changes were noted as early as the first day of the experiment. Observations also revealed muscular edema, dilated muscular fibers, destruction of contractile elements, enlarged muscle fibers, and atrophy and muscle disintegration. Changes in the size of muscle fiber were associated with altered enzyme activity. Cytochemical changes were also noted. Author

N72-22066# Joint Publications Research Service, Arlington, Va.
THE EFFECT OF HYPOKINESIA AND HYPODYNAMIA ON INTRAORGANIC CARDIAC ARTERIES
L. A. Aleksina *In its* Biol. Effect of Extreme Environ. Factors 6 Mar. 1972 p 112-116 refs (See N72-22053 13-04)
Avail: NTIS

The effects of prolonged restricted motor activity on the morphology of intraorganic cardiac arteries in rabbits are reported. Changes include myocardial capillary constrictions, dilation of arterioles, impairment of myocardial architectonics, and uneven filling and tortuous appearance of vessels. It was determined that the degree of change depends on the duration of restricted activity. E.H.W.

N72-22067# Joint Publications Research Service, Arlington, Va.
MORPHOLOGICAL CHANGES IN BRONCHIAL VESSELS ASSOCIATED WITH EXPERIMENTAL HYPODYNAMIA AND HYPOKINESIA
V. S. Baybara *In its* Biol. Effect of Extreme Environ. Factors 6 Mar. 1972 p 117-121 ref (See N72-22053 13-04)
Avail: NTIS

The effects of experimental hypodynamia and hypokinesia on the structure of intraorganic bronchial vessels of rabbits are studied. Observational results show marked dynamic changes in the vessels and extremely deformed nuclei in the endothelial cells. Changes were also noted in diapedesis of erythrocytes, occurrence of microvaricosities, prevalence of edema, arteriole constriction, venule and capillary hemorrhages, vascular wall breaks, and occlusion of the capillaries. E.H.W.

N72-22068# Joint Publications Research Service, Arlington, Va.
THE EFFECT OF GENERALIZED HYPODYNAMIA AND HYPOKINESIA ON THE PORTAL SYSTEM OF THE LIVER
A. V. Drozdova *In its* Biol. Effect of Extreme Environ. Factors 6 Mar. 1972 p 122-127 refs (See N72-22053 13-04)
Avail: NTIS

The changes occuring in the hepatic portal system caused by general hypokinesia and hypodynamia conditions are examined. Albino rats and rabbits were used as subjects. Morphological changes include constriction of small branches of segmentary and interlobular veins in the marginal segments or in the form of foci in different lobes. The segmentary and main branches of the portal vein dilated slightly or not at all. These changes progressively increased up to the 4th through 6th week, then became stabilized followed by regression. This suggests that the cardiovascular system has some adaptability to unusual conditions. E.H.W.

N72-22069# Joint Publications Research Service, Arlington, Va.
THE EFFECT OF HYPODYNAMIA AND HYPOKINESIA ON THE ARTERIAL BED OF THE RABBIT'S HIND LEGS
Z. A. Saryyeva *In its* Biol. Effect of Extreme Environ. Factors 6 Mar. 1972 p 128-134 refs (See N72-22053 13-04)
Avail: NTIS

Changes occurring in the arterial bed of a rabbit's hind legs under the influence of restricted movement are studied. The most marked change was noted in the leg muscles. After one week of restricted activity critical atrophy occurred becoming progressively severe as time passed. These extreme conditions also caused body weight loss, and changes in the architectonics of the arterial bed as seen in the constriction of secondary and tertiary branches of major vessels in the anterior and posterior femoral muscles. The arteries become straighter and extended as the intramuscular network constricts. Studies show the vessels are enlarged, anastomoses are poorly demonstrable between branches, the intramuscular network is more scant, and the fine vessels are constricted. E.H.W.

N72-22070# Joint Publications Research Service, Arlington, Va.
THE EFFECT OF HYPODYNAMIA AND HYPOKINESIA AND SUBSEQUENT HYPERGRAVITATION OF THE BLOOD VESSELS OF THE CAPSULE OF THE RABBIT'S KNEE JOINT
A. G. Lubeyev *In its* Biol. Effect of Extreme Environ. Factors 6 Mar. 1972 p 135-141 refs (See N72-22053 13-04)
Avail: NTIS

Experimental data on the effects of hypodynamia, hypokinesia, and hypergravitation on knee joint blood vessels are presented. It was demonstrated that hypodynamia and hypokinesia stresses led to vascular dystonia, hypeostasis, and, later on, to onset of hypertensive forms of hemodynamic disorders. Hypergravitation following hypokinesia leads to destructive changes in the vascular system of the knee joint capsule. Author

N72-22071# Joint Publications Research Service, Arlington, Va.
AGE-RELATED CHANGES IN VASCULARIZATION OF THE RAT'S SKELETAL MUSCLES AS RELATED TO NATURE OF EXERCISE
G. N. Lenskaya *In its* Biol. Effect of Extreme Environ. Factors 6 Mar. 1972 p 142-150 refs (See N72-22053 13-04)
Avail: NTIS

Albino mongrel rats were observed to determine the effect of age, moderate exercise, and increased or heavy exercise on vascularization in skeletal muscles. Results show that in rats exposed to moderate loads, little change is noted in muscular blood supply, whereas a considerable blood increase occurred in rats exposed to increased or heavy loads. Heavy exercise also induces an increase in the number of capillaries, increased capillary diameter, and an increase in the total capillary area. Moderate exercise opens up reserve capillaries. For the age factor, it was noted that in skeletal muscle the mean diameter of the fibers increased with age, but less variability of muscle fiber diameter occurs under physical loads. E.H.W.

N72-22072# Joint Publications Research Service, Arlington, Va.
SYMPOSIUM DEALING WITH THE INFLUENCE OF STRESS FACTORS ON STRUCTURE OF ORGANS AND TISSUES AT THE 9TH INTERNATIONAL CONGRESS OF ANATOMISTS
N. I. Zotova *In its* Biol. Effect of Extreme Environ. Factors 6 Mar. 1972 p 151-159 Conf. held at Leningrad, 20-21 Aug 1970 (See N72-22053 13-04)
Avail: NTIS

A review of information presented at the International Conference held in the Soviet Union is presented. Data cover the influence of stress factors on changes in the morphological processes of organs and tissues. A brief summary is given of each paper presented. E.H.W.

N72-22073*# Scripta Technica, Inc., Washington, D.C.
INFLUENCE OF MICROWAVE RADIATION ON THE ORGANISM OF MAN AND ANIMALS
I. R. Petrov, ed. NASA Feb. 1972 229 p refs Transl. into

ENGLISH of the book "Vliyaniye SVCh-Izlucheniya na Organizm Cheloveka i Zhivotnykh" Leningrad, Meditsina Press, 1970
(Contract NASw-2036)
(NASA-TT-F-708) Avail: NTIS CSCL 06R

The effect of the microwave field on the organism were studied. The biological bases of the action of microwave electromagnetic radiation on the organism are considered with experimental material on the influence of high and low microwave intensities on the animal organism, characterizing the functional changes of the organism's basic systems and its metabolism. Also considered is the question of damage due to microwaves combined with other factors and changes in the organism's immunological reactivity, the properties of bacteria, viruses, and simple animals. The influence of microwaves on the human organism and data acquired as a result of observations on volunteers as to the influence of low microwave intensities on the healthy human organism are studied along with the symptomatology, stages, reversibility of changes, and a classification for the pathological processes that arise under the influence of microwaves in persons working with microwave generators. Author

N72-22074# Defence Standards Labs., Maribyrnong (Australia).
FUNGI AT JOINT TROPICAL RESEARCH UNIT, INNISFAIL, QUEENSLAND. PART 1: GENERA OF MICROFUNGI GROWING ON MATERIALS
F. J. Upsher Jan. 1972 11 p refs
(TN-233) Avail: NTIS

The examination and classification of microfungi found growing on a variety of materials at Innisfail, Queensland, Australia are reported. Thirty-five genera of fungi are listed and their occurrence on the materials recorded. Author

N72-22075*# Scientific Translation Service, Santa Barbara, Calif.
GROWING PLANTS IN SPACE
V. P. Dadykin Washington NASA Apr. 1972 80 p refs Transl. into ENGLISH of the book "Kosmicheskoye Rasteniyevodstvo" Moscow, Znaniye Press, 1968
(Contract NASw-2035)
(NASA-TT-F-704) Avail: NTIS CSCL 06C

The possible ways to solve the problems connected with life support systems for cosmonauts on prolonged space flights by using plants from earth are examined. The cycle of nature on earth is examined, and methods are proposed for modeling this cycle within a spacecraft. The danger of radiation in space and ways to eliminate it are studied. It is found that in closed, pressurized areas higher plants are quite sensitive to increased oxygen in the air. A 25% concentration of oxygen greatly reduces the intensity of photosynthesis, whereas a concentration below normal stimulates plant growth and intensifies photosynthesis. Author

N72-22076*# Exotech, Inc., Washington, D.C.
QUARANTINE DOCUMENT SYSTEM INDEXING PROCEDURE Interim Report
Mar. 1972 180 p refs
(Contract NASw-2062)
(NASA-CR-126215; TR72-09) Avail: NTIS CSCL 06M

The Quarantine Document System (QDS) is described including the indexing procedures and thesaurus of indexing terms. The QDS consists of these functional elements: acquisition, cataloging, indexing, storage, and retrieval. A complete listing of the collection, and the thesaurus are included. F.O.S.

N72-22077*# Technology, Inc., San Antonio, Tex. Life Sciences Div.
THE INVESTIGATION OF VERTEBRAL INJURY SUSTAINED DURING AIRCREW EJECTION Annual Technical Report, 28 Jun. 1970 - 15 Jan. 1972
James V. Benedict 15 Jan. 1972 48 p refs
(Contract NAS2-5062)
(NASA-CR-114452) Avail: NTIS CSCL 06S

A series of tests were performed on excised human vertebral segments to determine the static and dynamic response of the thoraco-lumbar spine when loaded in flexion. A total of fifteen tests were performed on eleven specimens. Specimens were obtained from male donors ranging in age from 34 to 60 years. Demographic data pertinent to each specimen and the elapsed time between death of the donor and testing of each corresponding specimen are presented. Only spinal segments comprised of lower thoracic and upper lumbar vertebrae were tested because in aircraft ejection injuries clinical complications in this anatomical region predominate. A complex continuum mathematical model describing the dynamic response of the human spine was formulated, solved, and verified experimentally. Detailed results are presented in figures, tables, and equations. Author

N72-22078*# Techtran Corp., Glen Burnie, Md.
COMPARATIVE EVALUATION OF THE INFLUENCE EXERTED ON THE ORGANISM BY BORIDES AND CARBIDES OF TRANSITION METALS WITH CONSIDERATION OF THE CHARACTERISTICS OF THEIR ELECTRON STRUCTURE
I. T. Brakhnova Washington NASA Apr. 1972 10 p refs Transl. into ENGLISH from Gigena Truda i Prof. Zabolevaniya (Moscow), v. 13, 1969 p 26-31
(Contract NASw-2037)
(NASA-TT-F-14255) Avail: NTIS CSCL 06C

Experiments were carried out on animals for a comparative study of the effect producted on the organism by titanium boride, zirconium boride and chromium boride in comparison with amorphous boron and metallic components of these borides. Similarly, the effect of boron carbide, titanium carbide, zirconium carbide and chronium carbide were studied. An increased fibrogenic effect and a more pronounced distrophy of the liver, kidneys and sometimes of the myocardium were observed under the influence of borides to a greater extent than under that of carbides. The toxic properties of these materials increased with a decrease in the statistical weight of stable d(s) and sp(2) electron configurations, developing after interaction of the metallic and nonmetallic components and an increase in the proportion of electrons in the nonlocalized state. Author

N72-22079*# Public Health Service, Phoenix, Ariz. Applied Microbiology and Planetary Quarantine Section.
SERVICES PROVIDED IN SUPPORT OF THE PLANETARY QUARANTINE REQUIREMENTS Quarterly Report, Jan. - Mar. 1972
Martin S. Favero Mar. 1972 25 p refs
(NASA Order W-13062)
(NASA-CR-126213; Rept-37) Avail: NTIS CSCL 06M

Results are presented of laboratory experiments conducted on the thermal resistance of naturally occurring airborne spores and microbiological examinations of space hardware using long-term slit samplers and rodac plate and swab-rinse methods of sampling environmental surfaces. A.L.

N72-22080# University Central Hospital, Helsinki (Finland). Radiotherapy Clinic.
EXPERIMENTS ON THE INTERACTION OF IONIZING RADIATION AND TISSUES IN DIAGNOSTICS, THERAPY AND PROTECTION
Aaro Rytilae 1971 26 p refs
(NP-19051) Avail: AEC Depository Libraries

Brief summaries are presented of eight publications that discuss: dose distribution during electron beam therapy; scintigraphic studies of the prostate gland and placenta localization; the radiation dose to radiologists during various diagnostic radiographic studies; the effects of electrons on mitotic activity in normal and neoplastic tissues of rats; and methods for the reduction of the radiation dose to medical personnel during the insertion of radium applicators in patients. NSA

N72-22081# Federation of American Societies for Experimental Biology, Bethesda, Md.

A REVIEW OF ADVERSE BIOMEDICAL EFFECTS OF SOUND IN THE MILITARY ENVIRONMENT

C. Jelleff Carr and Kenneth D. Fisher Dec. 1971 113 p refs (Contract DAHC19-71-C-0011)

(AD-734932) Avail: NTIS CSCL 06/19

The report provides a comprehensive review of the adverse effects of sound on man in the military environment. The diversity and complexity of Army systems that overexpose the soldier to noise have caused concern for his health and his capability to perform efficiently. Despite the recognition of the deleterious effects of noise exposure, problems with noise-induced hearing loss and human performance decrement continue to enlarge. It is generally recognized that overexposure to high-intensity noise during a lifetime will result in progressive hearing loss. There is no way to correct permanent threshold shift; permanent hearing loss is irreversible. It is not possible at the present time to identify audiometrically individuals with increased susceptibility or resistance to injury from noise exposure. Protection by sound attenuating devices, such as earplugs or earmuffs, has proved to be the most practical way to protect and to conserve the hearing of men required to work in a noisy environment. Effective hearing conservation and reduction of noise-induced hearing loss are compromised by lack of adherence to existing Army regulations and frequent waiving of equipment design standards. Work should be directed toward reduction of noise at its source and, emphasis should be placed on increased support for Army Hearing Conservation Programs. The report identifies research opportunities that are related to Army needs.

Author (GRA)

N72-22082# American Inst. for Research, Pittsburgh, Pa.

DEVELOPMENT OF A TAXONOMY OF HUMAN PERFORMANCE: EVALUATION OF A TASK CLASSIFICATION SYSTEM FOR GENERALIZING RESEARCH FINDINGS FROM A DATA BASE Interim Technical Report

Warren H. Teichner and Joan Whitehead Apr. 1971 44 p refs (Contract F44620-67-C-0116; DAHC19-71-C-0004; ARPA Order 1032; ARPA Order 1623)

(AD-736192; AIR-726/2035-4/71-TR8; AIR-R71-11) Avail: NTIS CSCL 05/10

The paper reports on a research effort to assess the feasibility of constructing a data base for improving generalization of research results about human performance. A criterion measure task classification system was applied to a portion of the existing literature on learning and environmental variables. Optimum distribution of practice and knowledge of results were the two learning variables investigated. The environmental factor investigated was the effects of different noise intensities. It was shown that for certain variables and certain task conditions the categorization system was effective in predicting human performance across a variety of tasks. Implications for developing a data base are described. Author (GRA)

N72-22083# Naval Aerospace Medical Research Lab., Pensacola, Fla.

WALK ON FLOOR EYES CLOSED (WOFEC): A NEW ADDITION TO AN ATAXIA TEST BATTERY

Alfred R. Fregly, Ashton Graybiel, and Margaret J. Smith 1 Oct. 1971 17 p refs

(AD-735455; NAMRL-1144; NAVMED-MR41.01.0120B8FG-7) Avail: NTIS CSCL 06/16

The problem of quantifying a simple, often-used clinical ataxia test (tandem-walking) for inclusion in an ataxia test battery was overcome by adopting the method of counting the number of heel-to-toe steps (1 to 10) a person can take without sidestepping with eyes closed and arms folded against chest. Standardization under these rigid conditions was based on testing 287 normal men and 100 normal women. Validation was based on testing 22 individuals having labyrinthine defects of varying severity and origin. This newly quantified test was found to be as valid an indicator of vestibular ataxia as other subtests of a multidimensional quantitative ataxia test battery with which it was compared, and it has the advantages that, it appears to be free of age influences, and nearly all the normal and none of the abnormal individuals obtained a perfect score.

GRA

N72-22084# Naval Aerospace Medical Research Lab., Pensacola, Fla.

EXPOSURE OF SQUIRREL MONKEYS FOR LONG PERIODS TO EXTREMELY LOW-FREQUENCY MAGNETIC FIELDS: CENTRAL NERVOUS SYSTEM EFFECTS AS MEASURED BY REACTION TIME

James D. Grissett 21 Oct. 1971 14 p refs

(AD-735456; NAMRL-1146; NAVMED-MF12.524.015-0013B0X-2) Avail: NTIS CSCL 06/18

The present experiment was designed to detect cumulative central-nervous-system effects resulting from exposure to ELF magnetic fields. Three squirrel monkeys were exposed continuously for 42 days to a 10-gauss magnetic field at 45 Hz. Reaction-time measurements were taken daily for 23 days prior to exposure, during the exposure period, and for 9 days after exposure. No significant changes in these measurements were observed between control sessions and exposure or postexposure sessions. Two other indices of performance, reinforcement ratio and efficiency ratio, were also unchanged. These results indicate that if a psychophysiologically significant effect exists, it is probably quite subtle and will therefore require a broad range of very sensitive experiments to evaluate properly the long-term effects of the ELF environment. Author (GRA)

N72-22085# School of Aerospace Medicine, Brooks AFB, Tex.

EFFECT OF CONSTANT DIET ON MICROBIAL POPULATIONS OF HUMAN DENTAL PLAQUE Technical Report, Mar. 1969 - Oct. 1970

Carl J. Andres, Joseph T. Cordaro, Cecil E. Brown, Jr., and Bernard F. Podlin Nov. 1971 18 p refs

(AF Proj. 7753)

(AD-735275; SAM-TR-71-38) Avail: NTIS CSCL 06/13

Constant diet, minimal oral hygiene, and simulated weightlessness appeared to have no statistically significant effect on selected microbial populations of human dental plaque. Subjects were eight airmen participating in a concurrently conducted bed rest - exercise study. Oral prophylaxis and restoration of various teeth preceded the 16-week study, and minimal oral hygiene procedures were imposed. Samples were collected twice during the first week and once weekly thereafter. Standard bacteriologic plate count procedures were used to enumerate selected organisms. Total aerobes, total anaerobes, and populations of Actinomyces, Fusobacterium, Neisseria, Nocardia, and Veillonella generally tended to decrease throughout the study. Aerobic and facultative streptococci and populations of S. salivarius, Bacteroides melanogenicus, and Lactobacillus generally showed little change other than normal fluctuation. Only the weekly means for S. salivarius were significantly different for supra- and subgingival plaque. Correlation of bacterial count data with clinical observations indicate that the minimal oral hygiene procedures imposed during this study were sufficient to remove bacterial plaque and prevent shifts in predominant organisms in developing plaque, thereby maintaining the oral health status of the individual subjects. Author (GRA)

N72-22086# Army Medical Research and Nutrition Lab., Denver, Colo.

DEVELOPMENT AND APPLICATION OF A WHOLE-BODY RADIATION SYSTEM

Charles C. Scaief, III and Harry J. Krzywicki 12 Nov. 1971 41 p refs

(DA Proj. 3A0-14501-B-71R)

(AD-735649; AMRNL-330) Avail: NTIS CSCL 06/18

An instrument for detecting natural body burdens of radionuclides has been constructed at USAMRNL. The counting system uses a NaI(T1) scintillation crystal and a lead shadow-shield. The subject passes beneath the detector on a

padded sled at a speed proportional to the live time of the multichannel analyzer. Data is analyzed using the RCA 301/355 computer and punched paper tape. The detector was calibrated for measuring body potassium using six subjects with weight/height ratios varying from 0.368 Kg/cm to 0.620 Kg/cm. The calibration factor was found to be a linear function of weight/height for the range of body sizes considered. The counter has been used for measuring potassium, for body composition studies, and for tracer isotope retention measurements. GRA

N72-22087# California Univ., Los Angeles.
NEUROPHYSIOLOGICAL ESTIMATES OF HUMAN PERFORMANCE CAPABILITIES IN AEROSPACE SYSTEMS
Progress Report, 1 Oct. 1970 - 30 Sep. 1971
W. Ross Adey 30 Nov. 1971 17 p refs
(Contract F44620-70-C-0017; AF Proj. 9777)
(AD-735178; AFOSR-72-0072TR) Avail: NTIS CSCL 06/19

The report is a multiphase research effort which involves a number of very distinct and separate projects, some of which are listed. Neurophysiological correlates of tasks at the limit of operator capability; Totally implanted telemetry devices; Underwater telemetry; Telephone telemetry; Theory and methods of fuzzy clustering techniques; Investigations of CNS and endocrine system in the chimpanzee; Patterns of diurnal rhythms in urinary metabolites and electrolytes in men with spinal cord injury; Fluorescence spectroscopy and biological labelling; Effects of modulated VHF field on brain and behavior; Computer studies of EEG in normals and children with reading difficulties. GRA

N72-22088# Zaret Foundation, Inc., Scarsdale, N.Y.
INVESTIGATION OF PERSONNEL HAZARD ASSOCIATED WITH RADIO-FREQUENCY FIELDS ENCOUNTERED IN NAVAL OPERATIONS Final Report
Milton M. Zaret Jul. 1971 27 p refs
(Contract N00014-69-C-0358; NR Proj. 101-765)
(AD-735513) Avail: NTIS CSCL 06/18

A pragmatic, bio-assay experimental method was developed whereby meaningful radio-frequency hazard data can be obtained. The technique can be applied to any type of pure or mixed radio-frequency field from the simplest to the most complex. The animal, itself, serves as the cumulative dosimeter for registering psycho-physical effects. By utilizing two primates for each intensity duration function tested, the probability of a spurious radiation field effect is rendered negligible. By selecting the animals as a pair, one male and the other female, the entire spectrum of potential sex-related delayed effects, including mating, fertility, gestation and progeny, may be investigated. In addition to the search for specific, radiation induced signature pathology such as thermal cataracts, other types of pathology and functional disorders including behavioral and psycho-physical abnormalities may also be investigated simultaneously. The concept of developing health-safety data by the technique pioneered in this program represents one of the most meaningful state-of-the-art advances for determining radio-frequency hazards developed during the past decade. Author (GRA)

N72-22089# Walter Reed Army Medical Center, Washington, D.C. Army Medical Biomedical Research Lab.
[BIOMECHANICAL MEDICAL RESEARCH] Quarterly Progress Report, Apr. - Jun. 1971
1971 29 p refs
(AD-736375) Avail: NTIS CSCL 06/12

Contents: Antithrombotic surfaces; Biodegradable polymers; Bracing; Lower extremity exercise equipment; Wound dressings; Calcification; Hemostatic agents; Piezoelectric properties of bone; Viable and necrotic tissue differentiation; Externally powered prostheses; Cosmetic glove material; Eye lens calcification. GRA

N72-22090# Armed Forces Radiobiology Research Inst., Bethesda, Md.
REACTOR DOSIMETRY WITH PAIRED MINIATURE IONIZATION CHAMBERS
D. W. Shosa Dec. 1971 17 p refs
(AD-736177; AFRRI-TN71-7) Avail: NTIS CSCL 06/18

Paired ionization chambers with nominal volumes of 0.05 cc are in use at the Armed Forces Radiobiology Research Institute to measure neutron and gamma components of depth doses in steady-state and pulsed TRIGA fields. Cavity chamber theory is employed to obtain quantitative estimates of neutron and gamma dose sensitivities of a chamber with a tissue-equivalent plastic wall filled with a tissue-equivalent gas and magnesium chamber filled with CO2. The uncertainties in these estimates have been propagated through the paired chamber equations and result in the following uncertainties in measured dose components in a field where the neutron to gamma dose ratio varies from 0.1 to 15. Author (GRA)

N72-22091# Bureau of Radiological Health, Rockville, Md. Div. of Electronic Products.
RADIOFREQUENCY AND MICROWAVE RADIATION LEVELS RESULTING FROM MAN-MADE SOURCES IN THE WASHINGTON, D. C. AREA
Stephen W. Smith and David G. Brown Nov. 1971 75 p refs Prepared in cooperation with White Electromagnetics, Inc., Bethesda, Md.
(Contract CPE-R-22)
(PB-206216; BRH-DEP-72-5; FDA-72-8015) Avail: NTIS; SOD $0.75 CSCL 06R

In order to determine the typical levels of radiofrequency and microwave radiation that result from man-made sources in an urban environment, measurements were made of peak power densities in the Washington, D.C., area during the summer of 1969. The highest levels measured (approximately .01 mW/sq cm) originated primarily from AM broadcast towers and airport radar installations. Author (GRA)

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N72-22092* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SPACE SUIT HAVING IMPROVED WAIST AND TORSO MOVEMENT Patent
Hubert C. Vykukal, inventor (to NASA) Issued 25 Jan. 1972 7 p Filed 23 Mar. 1970 Supersedes N70-26799 (08 - 13, p 2330)
(NASA-Case-ARC-10275-1; US-Patent-3,636,564; US-Patent-Appl-SN-21644; US-Patent-Class-2-2.1A) Avail: US Patent Office CSCL 06K

A space suit is described with improved torso and waist movement. The space suit includes a canted rotory joint near the middle of the torso. The joint being set at an angle of about 30 deg to horizontal and tilting upwardly from the front. The space suit also preferably includes a double bellows for improved waist action. Official Gazette of the U.S. Patent Office

N72-22093* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
OPEN TYPE URINE RECEPTACLE Patent
Anthony S. Girala, inventor (to NASA) Issued 7 Sep. 1971 5 p Filed 13 Aug. 1970 Supersedes N70-41980 (08 - 24, p 4456)
(NASA-Case-MSC-12324-1; US-Patent-3,602,923; US-Patent-Appl-SN-63384; US-Patent-Class-4-110; US-Patent-Class-4-99; US-Patent-Class-128-295) Avail: US Patent Office CSCL 06I

An open-type urine receptacle is described, comprising a

tubular housing having inlet end and outlet ends. Within the housing is a honeycomb insert for polarizing the urine stream in order to eliminate splashback. Supported on the honeycomb insert and at one end thereof is a fine mesh screen insert adapted to serve as a wicking means upon completion of micturition. A receptacle cover is also provided for covering the open end of the housing and a vacuum removal tube is connected to the other end and in fluid communication with the interior. Official Gazette of the U.S. Patent Office

N72-22094*# Hamilton Standard, Windsor Locks, Conn.
INVESTIGATIONS TO IMPROVE CARBON DIOXIDE CONTROL WITH AMINE AND MOLECULAR SIEVE TYPE SORBERS
John F. Bertrand, Harlan F. Brose, Frank L. Kester, and Peter J. Lunde Mar. 1972 310 p refs
(Contract NAS1-8944)
(NASA-CR-112021; SVHSER-5966) Avail: NTIS HC $6.00/MF $0.95 CSCL 06K

The optimization trends and operating parameters of an integral molecular sieve bed heat exchanger were investigated. The optimum combination of substrate and coating for the HS-B porous polymer was determined based on the CO2 dynamic capacity in the presence of water vapor. Full size HS-B canister performance was evaluated. An Amine CO2 Concentrator utilizing IR-45 sorber material and available Manned Orbiting Laboratory hardware was designed, fabricated and tested for use as an experiment in the NASA 90-day space simulator test of 1970. It supported four men in the simulator for 71 days out of the 90-day test duration. Author

N72-22095# Joint Publications Research Service, Arlington, Va.
MEASURES AGAINST THE UNFAVORABLE EFFECT OF WEIGHTLESSNESS
A. Genin and I. Pestov 14 Apr. 1972 12 p Transl. into ENGLISH from Aviatsiya i Kosmonavtika (Moscow), no. 3, 1972 p 30-33
(JPRS-55714) Avail: NTIS

Methods designed to control or prevent the problems associated with weightlessness (sensation of increased body weight, decreased physical performance, deterioration in vertical posture tolerance, and gait changes) are investigated. The most promising methods are removal of hydrostatic blood pressure and the gravitational load on the muscular-skeletal system. Results revealed that these measures did not prevent the full development of unfavorable side effects, but did modify the disorders. It was also noted that for prolonged weightlessness such methods are ineffective. Descriptions are given of the instruments, machinery, and the training used in the experiments. E.H.W.

N72-22096*# Texas Technological Univ., Lubbock. Biomedical Instrumentation Lab.
THE DEVELOPMENT OF INSULATED ELECTROCARDIOGRAM ELECTRODES Final Report, 1 Jul. 1970 - 31 Dec. 1971
William M. Portnoy and Robert M. David 31 Dec. 1971 70 p refs
(Contract NAS9-11162)
(NASA-CR-115530) Avail: NTIS CSCL 06B

An integrated system was developed, consisting of an insulated electrode and an impedance transformer, which can be used for the acquisition of electrocardiographic data. The electrode consists of a thin layer of dielectric material deposited onto a silicon substrate. The impedance transformer is an operational amplifier used in the unity gain configuration. Both electrode and impedance transformer are contained in a plastic housing identical to that used with the NASA Apollo-type electrode. The lower cut off frequency of the electrode system is between 0.01 and 1.0 Hz, depending on the dielectric used and its thickness. Clinical quality electrocardiograms were obtained with these electrodes. Author

N72-22097# Flying Personnel Research Committee, London (England).
REVERSE FLOW PERSONAL VENTILATION
J. R. Allan, J. Morrison, and D. G. Robertson Jan. 1971 20 p refs
(FPRC/Memo-250) Avail: NTIS

The potential contribution of reverse flow personal ventilation for the relief of thermal stress in the aviation field is reviewed. Current evidence is discussed and recommendations are made for further research. Author

N72-22098*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
CARDIOTACHOMETER Patent Application
Hubert E. Smith, John R. Rasquin, and Roy A. Taylor, inventors (to NASA) Filed 7 Apr. 1972 16 p
(NASA-Case-MFS-20284; US-Patent-Appl-SN-242027) Avail: NTIS CSCL 06B

A device for accurate instantaneous measuring of the heart rate is described. The device measures the interval between two succeeding heart beats by counting cycles from a fixed frequency source occurring between the two beats. The heart rate is computed during the interval between the next two beats by counting the number of times that the interval count must be counted to zero in order to equal a total count of 60 times (to convert to beats per minute) the frequency of the fixed frequency source. NASA

N72-22099*# Systems Technology, Inc., Hawthorne, Calif.
DEVELOPMENT OF A CATEGORY 2 APPROACH SYSTEM MODEL
Walter A. Johnson and Duane T. McRuer Washington NASA May 1972 92 p refs
(Contract NAS2-4892)
(NASA-CR-2022; TR-182-2) Avail: NTIS CSCL 01B

An analytical model is presented which provides, as its primary output, the probability of a successful Category II approach. Typical applications are included using several example systems (manual and automatic) which are subjected to random gusts and deterministic wind shear. The primary purpose of the approach system model is to establish a structure containing the system elements, command inputs, disturbances, and their interactions in an analytical framework so that the relative effects of changes in the various system elements on precision of control and available margins of safety can be estimated. The model is intended to provide insight for the design and integration of suitable autopilot, display, and navigation elements; and to assess the interaction of such elements with the pilot/copilot. Author

N72-22100# Brookhaven National Lab., Upton, N.Y. Health Physics Div.
STANDARDS, STATISTICS AND STERNGLASS: GUILT BY ASSOCIATION
Andrew P. Hull and Ferdinand J. Shore (Queens Coll., N. Y.) 1971 54 p refs Presented at 6th Ann. Topical Symp. on Radiation Protect. Standards, Richland, Wash., 2-5 Nov. 1971 Sponsored by AEC
(BNL-16255; Conf-711119-2) Avail: NTIS

Existing radiation protection standards have been criticized on the grounds that radiation effects have been under-evaluated by the standards setting bodies. It has been postulated that the added risk at the presently permitted maximum exposure rate (500 mR/yr) will lead to an additional 61,880 deaths per million children born, and that concurrent increases in effluent releases from several nuclear facilities and in infant mortality in adjacent counties and/or states provides evidence that low-level radiation may have already produced more serious effects than believed possible when radiation standards were formulated. It is concluded that the above argument uses an extreme interpretation of data from studies by Stewart and Kneale and ignores data from other contrary studies. When examined in the context of the actual or calculated average effluent doses to be populations at risk and of

other sources of exposure, the claimed effects cannot reasonably be related to effluent releases. Author (NSA)

N72-22101# California Univ., Los Angeles. Lab. of Nuclear Medicine and Radiation Biology.
ECOLOGICAL ASPECTS OF PLUTONIUM DISSEMINATION IN TERRESTRIAL ENVIRONMENTS
J. J. Davis 1971 17 p refs Prepared in cooperation with AEC, Las Vegas, Nev.
(Contract AT-04-1-GEN-12)
(UCLA-12-848) Avail: NTIS

A research program to investigate the long range effects of plutonium disseminated into the desert ecosystem is outlined. Emphasis is placed on standardization of analytical methods, delineation of contaminated areas, problems of resuspension and redistribution, food chain transport, and ecological effects. Forty-seven references are contained in the report.
Author (NSA)

N72-22102# California Univ., Berkeley. Lawrence Berkeley Lab.
ABSORBED DOSE: AN UNFORTUNATE RED HERRING IN RADIATION PROTECTION
Alessandro Rindi and Ralph H. Thomas 25 Oct. 1971 27 p refs Presented at the 6th Ann. Topical Symp. on Radiation Protection Standards, Richland, Wash., 2-5 Nov. 1971
(Contract W-7405-eng-48)
(LBL-379; Conf-711119-5) Avail: NTIS

Man's uses of ionizing radiations are increasing rapidly, and larger numbers of people are being exposed to high linear energy transfer (LET) radiations. These radiations present interesting problems of dosimetry which are discussed in the light of experience at high energy accelerators. It is suggested that two aspects of our present scale for numerical expression in radiation protection need clarification. Firstly, the physical dimensions of dose equivalent (DE) should be defined and secondly, the precision with which DE estimates are to be made should be stated. The practical evaluation of DE in mixed radiation fields is discussed and it is suggested that this quantity is better obtained via measurements of particle flux density and energy spectra than by LET spectrometry. The advantages of the former technique over the latter are discussed briefly. Author (NSA)

N72-22103# Harry Diamond Labs., Washington, D.C.
ENGINEERING PERFORMANCE EVALUATION OF ARMY FLUIDIC VOLUME-CYCLED RESPIRATOR, MODEL 4
Leland R. Jones Dec. 1971 35 p refs
(HDL Proj. 31033; DA Proj. 3A0-62110-A-816)
(AD-736353; HDL-TM-71-32) Avail: NTIS CSCL 06/11

The overall performance of the previous Army volume-cycled respirator models was satisfactory; however, the flow consumption (61 lambda/min) was determined to be undesirably high. The Model 4 volume-cycled respirator was designed to reduce the required amount of flow while retaining the functions (volume- and pressure-cycling capabilities, assist and control) of the previous models by using low-power flueric components and combining the patient and power circuits. The maximum flow consumption of a breadboard model of this respirator was 21 percent of that required by the previous models, and general performance of this respirator exceeds that of the previous models. Author (GRA)

N72-22104# Naval Underwater Systems Center, Newport, R.I.
VISUAL SAMPLING ON A SIMULATED PPI DISPLAY
Richard L. Mason 30 Nov. 1971 28 p refs
(AD-736175; NUSC-4201) Avail: NTIS CSCL 05/10

Much effort has been spent in studying the sonar operator as a target detector. In general, it is assumed that the operator samples all the data available to him. This study discusses the operator's sampling procedure on a simulated plan position indicator (PPI) display. In visual sampling, information is obtained by an operator from a display by fixating points on the display with his eyes. The area near these points contains most of the information that the operator uses from the display to make a decision of 'target' or 'no target'. The use of the Electro-oculargram (EOG) is obtaining the operator's fixation points is discussed, along with the drift problems and a method to decrease drift by using feedback to the electrodes. Experimental results of an operator's sampling of a simulated PPI display are reported for two types of CRTs: storage and nonstorage. Author (GRA)

N72-22105# Martin Marietta Corp., Orlando, Fla.
TARGET AQUISITION STUDIES: (1) TRANSITION FROM DIRECT TO TV MEDIATED VIEWING. (2) TARGET ACQUISITION PERFORMANCE: COLOR VS MONOCHROME TV DISPLAYS Final Report, 1 Jan. - 31 Dec. 1970
Frank D. Fowler and Daniel B. Jones Jan. 1972 40 p refs
(Contract N00014-67-C-0340; NR Proj. 196-071)
(AD-736244; OR-11768) Avail: NTIS CSCL 17/2

Two aspects of air-to-ground daylight target acquisition were investigated. Study I examined the task of finding a target displayed on a cockpit-mounted CRT after the pilot had acquired it visually through the cockpit canopy. The effect of three different TV camera fields-of-view on the subject's ability to transition from outside to inside conditions was studied. The second experiment evaluated the differences in acquisition performance elicited by color and monochrome TV display presentations of ground targets. Author (GRA)

N72-22106# Harry Diamond Labs., Washington, D.C.
ARMY CO2/O2 CONCENTRATION MONITOR (MODEL 1)
Fernando Villarroel and Charles W. Ragsdale Dec. 1971 72 p refs
(DA Proj. 3A0-62110-A-816)
(AD-737003; HDL-TM-71-31) Avail: NTIS CSCL 06/2

A flueric-electronic system has been developed to continuously monitor the concentration of carbon dioxide and periodically measure the concentration of oxygen in respiratory gases. The sensor consists of two miniature flueric oscillators whose acoustic frequency depends on CO2 concentration; the sensor is coupled to a pressure transducer. The signal is electronically processed, and the gas concentration is indicated by a calibrated dial. The signal may also be recorded. The system has a low sampling rate (7 cc/sec) induced by a flueric suction unit operated by low-pressure gas. The humidity and temperature of the sampled gas are controlled by a humidity control unit operated by a flueric vortex tube. The system has been calibrated and is accurate to better than 0.3 percent carbon dioxide and 1 percent oxygen. Author (GRA)

N72-22622# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. Flight Deck Development Branch.
THE STATUS OF HUMAN PERCEPTUAL CHARACTERISTIC DATA FOR ELECTRONIC FLIGHT DISPLAY DESIGN
Keith T. Burnett *In* AGARD Guidance and Control Displays Feb. 1972 10 p refs (See N72-22621 13-21)
Avail: NTIS

N72-22624# Human Engineering Labs., Aberdeen Proving Ground, Md.
WHAT COLOR DISPLAY ELEMENT
John A. Barnes *In* AGARD Guidance and Control Displays Feb. 1972 11 p refs (See N72-22621 13-21)
Avail: NTIS

N72-22625# Litton Systems, Inc., Van Nuys, Calif. Data Systems Div.
THE INTEGRATED COCKPIT PROCEDURE FOR IDENTIFYING CONTROL AND DISPLAY REQUIREMENTS OF AIRCRAFT IN ADVANCED TIME PERIODS
John V. Murphy and Bernard S. Gurman (ECOM, Fort Monmouth, N. J.) *In* AGARD Guidance and Control Displays Feb. 1972

7 p refs (See N72-22621 13-21)
Avail: NTIS

N72-22626# Honeywell, Inc., Minneapolis, Minn. Systems and Research Div.
DESIGN IMPLICATIONS OF A BETTER VIEW OF THE MULTICHANNEL CAPACITY OF A PILOT
O. H. Lindquist *In* AGARD Guidance and Control Displays Feb. 1972 6 p refs (See N72-22621 13-21)
Avail: NTIS

N72-22629# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
A METHOD OF MAN-DISPLAY/CONTROL SYSTEM EVALUATION
Ruediger Seifert (British Aircraft Corp., Preston, England), Alan F. Daniels (British Aircraft Corp., Preston, England), and Klaus Schmidt *In* AGARD Guidance and Control Displays Feb. 1972 9 p refs (See N72-22621 13-21)
Avail: NTIS

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N72-22107* McDonnell-Douglas Co., Santa Monica, Calif.
REACTION OF FLUORINE WITH POLYPERFLUOROPOLYENES Patent
Madeline S. Toy, inventor (to NASA) Issued 1 Feb. 1972 5 p Filed 26 Mar. 1969 Sponsored by NASA
(NASA-Case-NPO-10862; US-Patent-3,639,510; US-Patent-Appl-SN-810815; US-Patent-Class-260-877) Avail: US Patent Office CSCL 07C

Polyperfluoropolyenes, such as polyperfluorobutadiene, are reacted with fluorine to either provide a saturated polymer chain and/or create reactive sites on the polymer chain. This is followed by exposure to a monomeric species which undergoes free radical polymerization to graft the monomer onto the polyperfluoropolyene. Official Gazette of the U.S. Patent Office

N72-22108 National Lending Library for Science and Technology, Boston Spa (England).
RESEARCH INTO THE REACTION BETWEEN MoO3 AND GRAPHITE DURING THE SEPARATE HEATING OF REAGENTS
Yu. A. Pavlov, S. B. Sheboldaev, G. Ya. Meshcheryakov, and V. I. Delan [1971] 8 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (Moscow), v. 9, 1971 p 17-19
(NLL-M-21245-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The effects of the presence of carbon on the rate of oxide sublimation were studied for heated specimens. The reaction between MoO3 and graphite was investigated, while MoO3 vapor was fed at different rates to the graphite. Author

N72-22109 National Lending Library for Science and Technology, Boston Spa (England).
THE EFFECT OF ADDITIONS ON THE ELECTRICAL CONDUCTIVITY OF TiO2 AND ITS INTERACTION WITH CARBON
Yu. A. Pavlov, T. G. Lenskaya, and L. M. Bednaya [1971] 7 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (Moscow), v. 9, 1971 p 9-12
(NLL-M-21243-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The electrical conductivity and the proportion of ion conductivity of TiO2 with additions of Cu20, Ca0, A1203, Fe203, and Nb205 were investigated. Ion conductivity was found by emf measurement using a solid electrolyte in a galvanic cell with separate gas areas. The solid electrolyte was TiO2 and the gas electrodes oxygen and air. Electrical conductivity was measured by the four-probe method. Interaction of TiO2 and C was examined using chromatography. The additions affect both ion conductivity and the chemical activity of the oxide, and their effect is related to an increase in the number of anion vacancies and increase in oxygen movement to TiO2. Author

N72-22110 National Lending Library for Science and Technology, Boston Spa (England).
ELECTROCHEMICAL CIRCUIT FOR THE STUDY OF THE PROPERTIES OF SULPHIDES
L. I. Armyanova and S. I. Filippov [1971] 9 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (Moscow), v. 14, no. 9, 1971 p 13-16
(NLL-M-21244-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A galvanic cell with solid electrolyte for studying the properties of sulfides was examined. The variations in silver and silver sulfide activities was studied using an electrochemical Ag/AgI/Ag2S/Pt circuit, in which AgI was the solid cation-conducting electrolyte. The nature of the conductivity was assessed from the specific resistances of AgI and Ag2S. The calculated conductivity activation energy for AgI was 43.7 kcal/mol. The potentials and activities of silver in silver sulfide were calculated from the experimental emf values. Structural changes occurring in the sulfide were assessed from the nature of silver activity variation in silver sulfide. Author

N72-22111 Du Pont de Nemours (E. I.) and Co., Wilmington, Del. Elastometer Chemicals Dept.
CHEMICALS FOR ELASTOMERS: NA-101, A DELAYED ACTION ACCELERATOR FOR NEOPRENE
D. H. Geschwind and R. S. Torey 1972 4 p
(Bull-63A) Copyright. Avail: Issuing Activity

The chemical product NA-101, tetrammethylthiourea, which is described has a very fast cure rate and a high state of cure in all types of compounds of neoprene. It can be used alone or in combination with secondary accelerators to obtain variations in processing safety, green stock stability, and rate or state of cure. Data is presented on the toxicity of NA-101 which was developed from animal tests. Author

N72-22112# Research Inst. of National Defence, Stockholm (Sweden).
SPECTROPHOTOMETRIC DETERMINATION OF IRON IN PLUTONIUM WITH BATHOPHENANTHROLINE.
Lars-Henrik Andersson and Elise Halloff Feb. 1972 7 p refs
(FOA-4-B-4054-A2) Avail: NTIS

A spectrophotometric method for the determination of iron in trace amounts in plutonium has been tested. The color-forming reagent used was bathophenanthroline. Iron(III) was reduced to iron(II), complexed with bathophenanthroline and extracted into chloroform. EDTA was used as a masking agent for plutonium. In the presence of different anions (chloride, nitrate, sulfate, perchlorate, and acetate) in the water phase the molar absorptivity of the complex was found to vary. The effect of chloride and nitrate ions was investigated and could be eliminated. Trouble in the extraction step caused by the presence of gallium could be overcome. When iron is estimated in 20-mg samples of plutonium the relative standard deviation obtained is slightly better than 1.2 percent of the iron concentration when the iron-to-plutonium mole ratio is around .002. The limit of detection is of the order of 0.1 micrograms of iron. Author

N72-22113*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LOW OUTGASSING POLYMERIC MATERIAL AND PREPARATION THEREOF Patent Application

Benjamin Seidenberg, inventor (to NASA) Filed 15 Feb. 1972 14 p
(NASA-Case-GSC-11358-1; US-Patent-Appl-SN-226551) Avail: NTIS CSCL 07D

A fluid polydimethylsiloxane resin having improved outgassing properties in the cured state consists of: a first polydimethylsiloxane oligomer having a weight average molecular weight of about 1800 to 2900 and a number average molecular weight of about 1500 to 2500; a second polydimethylsiloxane oligomer having a weight average molecular weight of about 10,000 to 12,000 and a number average molecular weight of 19,500 to 21,500; and a third polydimethylsiloxane oligomer having a weight average molecular weight of about 1,780,000 to 1,800,000 and a number average molecular weight of about 850,000 to 870,000. The fluid polydimethylsiloxane resin of the invention is obtained by pouring to a height of up to 2 inches a starting polydiemthylsiloxane resin and devolatilizing the starting resin at a temperature of about 125 to 150 C under a vacuum of at least 0.00001 torr. NASA

N72-22114*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
OIL AND FAT ABSORBING POLYMERS Patent Application
Harold E. Marsh, Jr., inventor (to NASA) Filed 22 Feb. 1972 19 p
(Contract NAS7-100)
(NASA-Case-NPO-11609-1; US-Patent-Appl-SN-228229) Avail: NTIS CSCL 07D

A polymer system and resulting method are described, which are useful for absorbing fats or oils. They comprise forming a cross-linked polymer with minimal cross-linking to obtain a polymeric network with a swelling ratio in oil or fat of at least ten, and thus an oil absorption greater than 900 weight percent. NASA

N72-22115*# Translation Consultants, Ltd., Arlington, Va.
STUDY OF THE REACTION: NaCl PLUS NaHSO4 PLUS SiO2 EQUALS Na2SiO3 PLUS SO3 PLUS HCl
O. K. Botvinkin and T. Ye. Golba Washington NASA Apr. 1972 4 p Transl. into ENGLISH from Keram. Steklo (Moscow), v. 9, no. 1, 1933 p 1
(Contract NASw-2038)
(NASA-TT-F-14270) Avail: NTIS CSCL 07B

Experimental use of sodium chloride and sodium bisulfate, waste products from acid plants is discussed. These are considered as substitutes for bases in short supply, for glassmaking. Author

N72-22116*# North Dakota State Univ., Fargo. Dept. of Polymers and Coatings.
QUANTITATION OF BURIED CONTAMINATION BY USE OF SOLVENTS. PART 1: SOLVENT DEGRADATION OF AMINE CURED EPOXY RESINS Interim Report
Alfred E. Rheineck, Robert A. Heskin, and Loren W. Hill Feb. 1972 22 p refs
(Contract NGR-35-001-012)
(NASA-CR-126306; IR-1) Avail: NTIS CSCL 07D

The solubility and/or swelling of cured epoxy resins was studied using the solubility parameter method. Determination of solubility parameters were found in order to select solvents for solvent-assisted degradation of cured epoxy polymers used in spacecraft. A method for improving recovery of seeded spores is suggested for assay of buried contaminants. Three commercial epoxy resins were cured using four different alkyl amines. For each resin-amine combination, three levels of amine were used, corresponding to 1/3, 2/3, and all of the amine required to react with the oxirane groups of the resin. The solubility parameters of the 36 resulting model compounds were determined in poorly and moderately hydrogen-bonded solvents. No strongly hydrogen-bonded solvents caused dissolution or swelling. The tolerance of cured resins is discussed in terms of polymer structure. Author

N72-22117# Oak Ridge National Lab., Tenn.
EFFECT OF OXYGEN ON TANTALUM-SODIUM COMPATIBILITY
R. L. Klueh Dec. 1971 20 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3590) Avail: NTIS

The effect of oxygen in both phases on the compatibility of tantalum with sodium was investigated at 600 C in static capsule tests. Increasing the oxygen concentration of the sodium from 50 to 12,000 ppm led to increased dissolution of the tantalum in the sodium. It was concluded that the addition of oxygen to sodium results in the formation of a loosely adhering ternary oxide scale on the tantalum surface. In sodium with more than 1000 ppM O, the ternary oxide also formed along grain boundaries. When the concentration of oxygen in tantalum before test exceeded 200 ppM, sodium penerated the tantalum. Pentration proceeded with the formation of a ternary oxide by a wedging mechanism. At low oxygen concentrations attack occured along grain boundaries, and as the oxygen concentration of the tantalum increased, the number of grain boundaries attacked and the depth of attack increased. Still higher oxygen concentrations induced transgranular attack. Author (NSA)

N72-22118# Explosives Research and Development Establishment, Waltham Abbey (England).
MASS SPECTROMETRIC ANALYSIS OF COMPLEX GAS MIXTURES
N. C. Paul Feb. 1971 12 p
(ERDE-TN-28; BR-25066) Avail: NTIS

Accurate analyses are required on gases evolved during explosive and propellant trials. At least eight components can be identified and determined simultaneously from the single mass spectrum of the mixture. Calculation of results by computer reduces the analysis time such that ten analyses can be completed within one hour. Author (ESRO)

N72-22119# TRW Systems Group, Redondo Beach, Calif.
NANOSECOND AND PICOSECOND PHOTOCHEMISTRY WITH LASERS Final Research Report, 1 Oct. 1968 - 30 Dec. 1971
M. W. Windsor and J. R. Novak Jan. 1972 36 p refs
(Contract F44620-69-C-0029; AF Proj. 9538)
(AD-735789; AFOSR-72-0168TR; TRW-10873-6008-R0-00) Avail: NTIS CSCL 07/5

Pulsed lasers are excellent light sources for studying primary events in photochemistry. Previously a Q-switched ruby laser and a laser-induced spark was used to observe excited singlet states of aromatic compounds on a nanosecond time scale. In the reported research the authors have extended the time resolution of laser photolysis onto the picosecond time range. They used the second harmonic (530 nm) of a mode-locked neodymium/glass laser as an excitation source. The self-phase modulation continuum produced when 530nm picosecond laser pulses are focussed into glass, water and other optical media was employed. Using the continuum as a monitoring source they observed inverse Raman spectra in several molecules and a short lived transient absorption in Rhodamine 6G. Observation of short lived absorption by excited molecular states is of importance in understanding the dynamics of laser control materials such as those used for Q-switching and mode-locking. Author (GRA)

N72-22120# Aerospace Corp., El Segundo, Calif. Aerodynamics and Propulsion Research Lab.
A NEW METHOD FOR ENUMERATING MOLECULAR CONFIGURATIONS IN PROPELLANT MIXTURES Report for Jun. 1970 - May 1971
Nev A. Gokcen and Elfreda T. Chang 15 Nov. 1971 62 p refs
(Contract F04701-71-C-0172)
(AD-735306; TR-0172(2210-10)-1; SAMSO-TR-71-324) Avail: NTIS CSCL 07/4

A method has been developed for enumerating all the possible configurations in one-, two-, and three-dimensional

solutions of two components. The enumerations have been completed for 24 two-dimensional and 3 three-dimensional solutions. A new and exact formula for all configurations in unidimensional solutions has been derived. These enumerations substituted in the partition functions are capable of yielding all the useful thermodynamic properties of mixtures consisting of simple molecules of elements and compounds utilized in chemical propulsion. Author (GRA)

N72-22121# Purdue Univ., Lafayette, Ind.
COMPARISON OF THE ABSOLUTE QUANTUM YIELDS OF THE GAS PHASE O/NO REACTION AND THE LIQUID PHASE LUMINOL OXIDATION CHEMILUMINESCENCE LIGHT STANDARDS
Arthur Fortijn and John Lee Dec. 1971 22 p refs Prepared in cooperation with Aerochem Res. Labs., Inc., Princeton, N. J. and Ga. Univ., Athens
(Contract N00014-67-A-0226-0005; NR Proj. 098-038; NR Proj. 098-038; Proj. SQUID)
(AD-736585; SQUID-TR-AC-11-PU; AeroChem-TP-274) Avail: NTIS CSCL 07/5

Chemiluminescence intensities from the O/NO gas phase reaction and from luminol (3-aminophthal hydrazide) oxidation in the liquid phase have been measured under the same conditions of geometry, optics and detection over the wavelength range 440-530 nm. The measurements show that the rate constant for O/NO emission and the luminol chemiluminescence quantum yield lead to monochromator-photomultiplier calibrations which agree to within a factor of 1.09 plus or minus 0.40. The correction factors for refraction and light trapping which have to be considered when comparing liquid to gas phase luminescence intensities are briefly discussed. Author (GRA)

N72-22122# Ballistic Research Labs., Aberdeen Proving Ground, Md.
QUANTUM MECHANICAL STUDIES ON CHEMICAL REACTIVITY AND BALLISTIC CHEMISTRY. 1: CNDO/2 CALCULATIONS ON PYRROLE AND ON ITS AZA DERIVATIVES
Michael A. Schroeder, Ray C. Makino, and William M. Tolles Nov. 1971 43 p refs
(DA Proj. 1T0-61101-A-91A)
(AD-736371; BRL-1557) Avail: NTIS CSCL 07/4

As part of a program of quantum-chemical calculations on chemical reactivity and ballistic chemistry, the authors have calculated the electronic structures of pyrrole and its aza derivatives by the CNDO/2 method. The variation with structure of the calculated electron-distributions for these molecules can be understood in terms of organic chemical concepts such as resonance and inductive effects, with sigma-pi electron repulsion apparently playing a role in some cases. The relative merits of idealized and experimental geometrical models in calculations of this type are discussed. Solvent and other effects which may affect the reliability of the calculated electron distributions are discussed. Comparisons between calculated and observed dipole moments are also given. Author (GRA)

N72-22312*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MECHANISMS FOR THE ADHESION OF SILVER TO GLOW DISCHARGE SENSITIZED PERFLUORINATED ETHYLENE PROPYLENE (PEP)
John B. Schutt, William H. Gilchrist, and Frank N. Paczkowski *In its* Space Simulation 1972 p 1059-1071 refs (See N72-22250 13-11)
(Paper-84) Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 07D

07 COMMUNICATIONS

Includes communications equipment and techniques, noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N72-22123 British Broadcasting Corp., Kingswood (England). Research Dept.
THE OPTIMUM CHARACTERISTICS FOR A SIMPLE LUMINANCE NOTCH IN A PAL COLOUR TELEVISION DECODER
S. J. Lent Mar. 1972 6 p refs
(BBC-1972/7; PH-82) Avail: BBC, Kingswood Warren, Tadworth, Surry, England

The various considerations which govern the characteristics of a luminance notch filter in a PAL decoder are discussed. Subjective experiments are described which were carried out to find the optimum characteristics of such a filter. Author

N72-22124 British Broadcasting Corp., Kingswood (England). Research Dept.
REFLECTOMETER UNITS FOR SHORT-WAVE SENDERS
R. D. C. Thoday and A. G. Lyner Mar. 1972 11 p ref
(BBC-1972/8; RA-95) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

Reflectometer equipment has been developed for use on 100 kW and 250 kW high frequency senders. The equipment provides indications of carrier power, reflection coefficient, unbalanced-to-balanced power ratio, and peak values of maximum line voltages. Trip setting and logic circuits are provided to give increased protection to the senders during normal operation. Eight units have been provided for the Far Eastern Relay Station at Tebrau. Author

N72-22125 British Broadcasting Corp., Kingswood (England). Research Dept.
UHF MEDIUM DISTANCE TROPOSPHERIC PROPAGATION MEASUREMENTS OVER THE ENGLISH CHANNEL
C. P. Bell and S. J. Ashdown Mar. 1972 17 p refs
(BBC-1972/6; RA-94) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The statistical results of a number of long term propagation tests carried out over various representative transmission paths in the channel area are summarized. This information is required to determine not only the most suitable link path, but also the degree of complexity of the equipment required at the receiving terminal. Author

N72-22126 Japan Broadcasting Corp., Tokyo.
TELEVISION STANDARDS CONVERTER
Haruo Sakata, Hiroshi Tanimura, Ryuichi Kaneko, Hideo Kusaka, Toshiya Saito, Takashi Uehara, Tokuji Kubo, and Minori Yokozawa Mar. 1971 38 p refs
(NHK-Tech-Meno-17) Copyright. Avail: Issuing Activity

Techniques for television standards conversion to permit international interchange of television programs are discussed. After describing the disadvantages of several conversion systems, the decision is made to use the delay line switching system, since this system allows direct conversion of the television signals with little picture quality deterioration. The system requires delay lines of various lengths and may be large in size. The research work to produce the system is described. The electronic components required and the technical operation of the equipment are explained. Author

N72-22127* Hughes Aircraft Co., Los Angeles, Calif.
CONICAL REFLECTOR ANTENNA Patent
Arthur F. Seaton, inventor (to NASA) Issued 23 Nov. 1971

10 p Filed 11 Aug. 1969 Supersedes N70-36055 (08 - 19, p 3501) Sponsored by NASA
(NASA-Case-NPO-10303; US-Patent-3,623,114; US-Patent-Appl-SN-848776; US-Patent-Class-343-771; US-Patent-Class-343-797; US-Patent-Class-343-853; US-Patent-Class-343-912) Avail: US Patent Office CSCL 09E

A conical reflector antenna with a feed that is either a close approximation to a line source or a cylindrical structure which is electrically equivalent to a line source is described. Nearly complete control of its aperture illumination function is achieved by exciting various amounts of the line source or cylindrical feed. In addition to beamwidth control of a collimated beam that is linearly or circularly polarized, phase-sensing monopulse operation is made possible by dividing a cylindrical feed structure into three equal sectors and incorporating conventional directional couplers for obtaining the difference between received signals from sectors on either side of a vertical axis for azinuth error, and the weighted difference between the sum of those signals and the signals from the third sector for an elevation error.

Official Gazette of the U.S. Patent Office

N72-22128 British Broadcasting Corp., Kingswood (England). Engineering Div.

FIELD-STORE STANDARDS CONVERSION: THE DEVELOPMENT OF VARIABLE-DELAY TIMING CORRECTORS

D. W. Osborne and A. Roberts 1972 10 p refs
(BBC-1972/5) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The need for the development of new timing correctors for the BBC C06/508 field-store converter/synchroniser is discussed and outline descriptions of each stage of the timing corrector are given. The corrector consists essentially of a variable delay which is automatically adjusted at the beginning of each television line to reduce perturbations of up to + or - 16 microns in the timing of the input signal to a target accuracy of + or - 1 ns for the output signal.

Author

N72-22129*# Alabama Univ., University. Communication Systems Group.

CHARACTERIZATION OF IMPULSE NOISE AND ANALYSIS OF ITS EFFECT UPON CORRELATION RECEIVERS

Ronald C. Houts and Jerry D. Moore Oct. 1971 127 p refs
(Contract NAS8-20172)
(NASA-CR-123611; TR-135-102) Avail: NTIS CSCL 17B

A noise model is formulated to describe the impulse noise in many digital systems. A simplified model, which assumes that each noise burst contains a randomly weighted version of the same basic waveform, is used to derive the performance equations for a correlation receiver. The expected number of bit errors per noise burst is expressed as a function of the average signal energy, signal-set correlation coefficient, bit time, noise-weighting-factor variance and probability density function, and a time range function which depends on the crosscorrelation of the signal-set basis functions and the noise waveform. A procedure is established for extending the results for the simplified noise model to the general model. Unlike the performance results for Gaussian noise, it is shown that for impulse noise the error performance is affected by the choice of signal-set basis functions and that Orthogonal signaling is not equivalent to On-Off signaling with the same average energy.

Author

N72-22130*# Allied Research Associates, Inc., Baltimore, Md.

WEAKLY STATIONARY NOISE FILTERING OF SATELLITE-ACQUIRED IMAGERY

J. J. O. Palgen, I. Tamches, and E. S. Deutsch Dec. 1971 40 p refs
(Contract NAS5-21617)
(NASA-CR-122381; Rept-9G90-11; TR-3) Avail: NTIS CSCL 20F

A type of weakly stationary noise called herringbone noise was observed in satellite imagery. The characteristics of this noise are described; a model for its simulation was developed. The model is used to degrade pictorial data for comparison with similar noise degraded Nimbus data. Two filtering methods are defined and evaluated. A user's application demonstration is discussed.

Author

N72-22131# Australian Post Office Research Labs., Melbourne.

SATELLITE COMMUNICATIONS TO REMOTE AREAS

E. R. Craig,(ed.).D. R. C. Snowden, P. Kelleher, G. L. Crew, J. B. Potter, R. H. Blair, D. Blackwell, S. Sastradipradja, C. Doring, O. F. Lobert et al Dec. 1971 225 p refs
(Rept-6660) Avail: NTIS

A study to determine the feasibility of providing telephone communication to remote areas of Australia using communication satellites is presented. The subjects discussed are: (1) systems aspects of satellite communications to remote areas, (2) the experimental objectives and program, (3) the communications channel design, (4) the experimental equipment, (5) error detection and measuring equipment, and (6) experimental results.

Author

N72-22132*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

A STUDY OF FM THRESHOLD EXTENSION TECHNIQUES

G. D. Arndt and F. J. Loch Washington Apr. 1972 56 p refs
(NASA-TR-R-384; MSC-S-306) Avail: NTIS CSCL 17B

The characteristics of three postdetection threshold extension techniques are evaluated with respect to the ability of such techniques to improve the performance of a phase lock loop demodulator. These techniques include impulse-noise elimination, signal correlation for the detection of impulse noise, and delta modulation signal processing. Experimental results from signal to noise ratio data and bit error rate data indicate that a 2- to 3-decibel threshold extension is readily achievable by using the various techniques. This threshold improvement is in addition to the threshold extension that is usually achieved through the use of a phase lock loop demodulator.

Author

N72-22133*# Pennsylvania State Univ., University Park. Radio Astronomy Observatory.

ALMUCANTAR RADIO TELESCOPE REPORT 1: A PRELIMINARY STUDY OF THE CAPABILITIES OF LARGE PARTIALLY STEERABLE PARABOLOIDAL ANTENNAS

Peter D. Usher Aug. 1971 99 p refs
(Grant NGL-39-009-015)
(NASA-CR-126148; SR-025) Avail: NTIS CSVL 09A

The almucantar radio telescope development and characteristics are presented. The radio telescope consists of a paraboloidal reflector free to rotate in azimuth but limited in altitude between two fixed angles from the zenith. The fixed angles are designed to provide the capability where sources lying between two small circles parallel with the horizon (almucantars) are accessible at any one instant. Basic geometrical considerations in the almucantar design are presented. The capabilities of the almucantar telescope for source counting and for monitoring which are essential to a resolution of the cosmological problem are described. Author

N72-22134# Japan Broadcasting Corp., Tokyo.

STUDY OF ORBIT/FREQUENCY UTILIZATION FOR SATELLITE BROADCASTING, PART 1

Misao Matsushita, Eiichi Sawabe, Jun Shimaoka, Junji Majima, Yutaka Masuko, and Takehiro Izumi May 1971 16 p
(NHK-Labs-Note-143-Pt-1) Avail: NTIS

The technical procedures for determining the effective orbit/frequency utilization for a geostationary broadcasting satellite, different from those of a geostationary communications satellite are described. The factors and procedures that affect the orbit/frequency and the calculation of the co-channel interference ratio resulting from broadcasting satellites using the 12 GHz band are discussed. An application example of the elemental number of frequency channels for covering the assumed region of the world is included. Author

N72-22135# Japan Broadcasting Corp., Tokyo.
A MEMORY COLOR EXPERIMENT DEVICE
Masso Sugimoto, Misao Ezawa, and Takao Tamura Aug. 1971 11 p refs
(NHK-Labs-Note-144) Avail: NTIS

A memory color experiment to investigate colors retained in the human mind is discussed. The purpose of the experiment is to determine the color preferences of television viewers in order to provide television reception of maximum acceptability by the television audience. The equipment used to conduct the color preference tests on more than 200 subjects and the conditions under which the tests were conducted are described. Author

N72-22136# Advisory Group for Aerospace Research and Development, Paris (France).
TECHNICAL EVALUATION REPORT ON AGARD SPECIALISTS MEETING ON RADAR
J. Frihagen (Norwegian Defense Res. Estab., Kjeller) Jan. 1972 21 p refs Conf. held at Lindau/Harz, West Germany, 13-17 Sep. 1971
(AGARD-AR-33) Avail: NTIS

A conference on radar propagation in the Arctic is presented, including sessions on polar morphology, VHF-UHF propagation backscatter, polar cintillation, VHF propagation transmission, and HF propagation backscatter. Summaries, recommendations, and future studies are considered for radio aurora, radar aurora, VHF-UHF incoherent scatter, scintillation, and satellite beacon studies. Backscatter observations and HF scatter and communications are also reviewed. J.A.M.

N72-22137# Royal Aircraft Establishment, Farnborough (England).
AN OPTICAL COMMUNICATION SYSTEM USING A XENON ARC LAMP
B. Luff Sep. 1971 28 p refs
(RAE-TR-71183; BR-27240) Avail: NTIS

A communication system is described which uses a xenon arc lamp as the radiator. This source is virtually isotropic and produces a broad spectral output which may be amplitude modulated. The modulation and demodulation techniques, and an application to a short range telemetry, or remote control system are described. Author (ESRO)

N72-22138# Helsinki Univ. (Finland). Radio Lab.
SOME PROPERTIES OF LOSSLESS BIANISOTROPIC MEDIA
Ismo V. Lindell 1971 6 p refs Submitted for publication
(S-45-1971) Avail: NTIS

Conditions for the constitutive dyadic parameters of a lossless bianisotropic medium are derived. Applying these conditions it is shown that a conservation relation, previously shown to hold for lossless anisotropic media, also holds for lossless bianisotropic media. Author (ESRO)

N72-22139# Microwave and Electronic Systems Ltd., Edinburgh (Scotland).
DESIGN AND DEVELOPMENT OF AN S-BAND COAXIAL CIRCULATOR
J. M. Alexander, J. Helszajn, and K. V. Robb Paris ESRO Jun. 1971 37 p refs
(Contract ESTEC-1217/70)
(ESRO-CR-45) Avail: NTIS

The engineering phase of the design and development of an S-band coaxial circulator for use in satellite-borne communication systems is described. The circulator's junction is directly coupled and consists of composite dielectric-ferrite garnet material with high temperature stability as shown by thermal cycling tests. A power test was carried out to determine insertion loss and isolation, and the magnetic shielding was checked. The design ensures minimum weight and size, and the insertion loss is shown to be low. ESRO

N72-22140# Academy of Sciences (USSR), Moscow. Inst. for Space Research.
ADAPTIVE CODING OF POISSON SOURCES
Y. M. Shtarkov and N. E. Rybeva 1972 14 p refs
(PR-93) Avail: NTIS

The efficiency of universal, or adaptive, coding is investigated for a class of Poisson sources. The specific choice of the source class is necessitated by the fact that many physical investigations especially in outer space lead to such a model. An algorithm is developed to determine the redundancy of adaption coding for a stationary source, the efficiency of which is defined by the behavior of a function F. The parameters of this function are estimated by using the maximum probability principle. It is pointed out that the coding method is nonoptimal but efficient. ESRO

N72-22141# Academy of Sciences (USSR), Moscow. Inst. for Space Research.
ADAPTIVE CODING FOR DISCRETE SOURCES
Y. M. Shtarkov 1972 15 p refs
(PR-92) Avail: NTIS

The problems of estimate method selection, the relation between the sequence of m letters that precede the coded block and block length n, the efficiency of the adaptive method, and the optimal adaptive algorithm remain unsolved. Even for the simplest parameter estimation method and some specific sets of sources the efficiency of the adaptation principle turns out to be high. It is assumed that its introduction in source coding may solve the problem of unknown statistical distributions for all stationary and nonstationary sources. ESRO

N72-22142# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RADIO ENGINEERING SYSTEMS (SELECTED ARTICLES)
26 Oct. 1971 50 p Transl. into ENGLISH from the book "Radiotekhn. Ustroisva" Moscow, 1969 p 512-609
(AD-735465; FTD-HT-23-280-71) Avail: NTIS CSCL 17/2

The selected articles consist of state standards for (1) class A3J single-sideband low-level HF radiotelephone communication radio sets (transceivers); (2) long-line radio communication transmitters: and (3) frequency- and phase-modulated low-level UHF radio sets for use in the national economic sector. Each standard gives a list of the basic parameters employed. Author (GRA)

N72-22143# Washington Univ., Seattle. Dept. of Electrical Engineering.
PROPAGATION OF MILLIMETER WAVES IN RAIN
James C. Lin and Akira Ishimaru May 1971 36 p refs
(Contract F19628-69-C-0123; AF Proj. 8682)
(AD-735291; AFCRL-71-0310; SR-4; TR-144) Avail: NTIS CSCL 17/2

The paper considers multiple scattering effects of millimeter wave propagation in rain. Using the multiple scattering theory developed previously by the authors for beam and plane waves propagating in an isotropically scattering discrete random medium, rainfall attenuations were computed for intensities ranging from 0-100 mm/hr at wavelengths 3-30 mm. The results are compared with existing measurements in the literature. The good agreement between theory and experiment indicates the general applicability of the theory to rainfall attenuation predictions and area rainfall intensity estimations. The theory also agrees with calculations based on existing theory that accounts for drop size distributions. The difference in attenuation of plane and beam waves propagating in rain of the same intensity has found not to exceed 3 db/Km. The limits of applicability of the theory have also been indicated. Author (GRA)

N72-22144# Army Electronics Command, Fort Monmouth, N.J.
THE EFFECT OF FOLIATION ON TRANSMISSION FROM A TOROID-COUPLED TREE

Robert T. Hoverter and William Kennebeck Sep. 1971 25 p ref
(DA Proj. 1H6-62701-A-448)
(AD-735328; ECOM-3473) Avail: NTIS CSCL 09/5

Preliminary tests using toroid-coupled trees as antennas for propagation of radio waves raised question as to the natural cause for the increased propagation efficiency. A two month test was conducted in the spring 1970 (27 March - 22 May) to determine what effect foliation had on the performance of a tree as an antenna. It was observed that at 3.075 MHz operating frequency that no change in the propagation occurred during the process of foliation. Author (GRA)

N72-22145# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE ASYNCHRONOUS TAPE RECORDER KMZ 1000 DESCRIBED
Lubos Hilgert 22 Nov. 1971 13 p refs Transl. into ENGLISH from Automatizace (Czechoslovakia), v. 13, no. 9, 1970 p 237-240
(AD-736495; FTD-HC-23-1504-71) Avail: NTIS CSCL 14/3

The paper describes the construction and operation of a multichannel record and read system which may be used in an asynchronous, step wise, and also synchronous, continuous, mode. The fast start-stop facility permits the processing of the recording in block separated by gaps. An NRZI method of recording with a density of 200, 400, 556, and 800 bpi is used. Author (GRA)

N72-22146# Analytical Systems Corp., Burlington, Mass.
POLAR FOX 2 STUDY PHASE Final Technical Report
John R. Herman and R. Vargas-Vila Nov. 1971 246 p refs
(Contract F30602-71-C-0250; ARPA Order 1765)
(AD-736469; RADC-TR-71-276) Avail: NTIS CSCL 20/14

Auroral phenomena related to HF radiowave propagation are investigated to establish regions where and times when spectral spreading, backscatter echoes and radiowave absorption may be expected on signals propagating in polar latitudes. The spatial and temporal patterns of energetic particle precipitation are summarized in relation to ionospheric effects observed in the D, E and F regions to provide a background for the analysis of similar patterns in auroral ionospheric phenomena. Author (GRA)

N72-22147# Illinois Univ., Urbana. Antenna Lab.
INVESTIGATION OF SOME ELECTRICALLY SMALL CONICAL LOG-SPIRAL ANTENNAS Annual Report, 1 Oct. 1970 - 31 Aug. 1971
John D. Dyson 30 Sep. 1971 122 p refs
(Contract F19628-70-C-0230; AF Proj. 627A)
(AD-736500; UIAL-71-14; ESD-TR-71-297) Avail: NTIS CSCL 09/5

The report is concerned with an evaluation and an experimental study of the radiation patterns, power gain, and voltage standing wave ratio of balanced and unbalanced spiral antennas when operated at wave-lengths much longer than would be considered normal for this size structure. The unbalanced antenna which was studied was a bifilar logarithmic spiral constructed on a dielectric cone with an inner metal core to house electronic equipment. At the base, one arm is bonded to the core. Author (GRA)

N72-22148# Aerospace Corp., El Segundo, Calif. Office for Technology.
METALLIC LENS AND RADOME FOR X-BAND AND K-BAND SURVIVAL GROUND-TERMINAL ANTENNAS
Jimmy K. Wong, Howard E. King, and Robert B. Dybdal 15 Aug. 1971 92 p refs
(Contract F04701-71-C-0172)
(AD-736025; TR-0172(2320-01)-1; SAMSO-TR-71-335) Avail: NTIS CSCL 09/5

The report describes the characteristics of metallic lens and radome in the upper SHE and low EHF frequency range. For the present application, antenna hardness is a requirement, and large waveguide openings are necessary for the passage of debris associated with the blast. Such openings are large in terms of wavelengths and cause grating lobes that deteriorate radiation performance. Design curves are presented for a plano-concave lens, and the concept of using a metallic grating as a radome is described. The severity of the grating lobe effects if verified by measurements performed on a metallic grating. Author (GRA)

N72-22149# Avco Corp., Wilmington, Mass. Systems Div.
BREAKDOWN IN THE NEAR FIELD OF RE-ENTRY VEHICLE ANTENNAS Final Report, 1 Nov. 1968 - 31 Oct. 1971
Ronald L. Fante, Joaquin J. Otazo, Joseph T. Mayhan, and Jerrold M. Yos 15 Nov. 1971 22 p refs
(Contract F19628-69-C-0121; AF Proj. 4642)
(AD-736458; AVSD-0513-71-RR; AFCRL-71-0560) Avail: NTIS CSCL 20/14

The research included: (a) a detailed study of the bounds on the near electric field of antennas, (b) calculation of the near electric field of specific antennas, (c) calculation of the breakdown power for various antenna configurations, (d) the effect of time-varying plasmas and non-linearites on microwave breakdown, (e) high temperature effects on breakdown, and (f) a study of miscellaneous reentry effects. Author (GRA)

N72-22150# Illinois Univ., Urbana. Dept. of Electrical Engineering.
A STUDY OF THE RELATION BETWEEN THE MAXIMUM USABLE FREQUENCY AND ELECTRON CONTENT IN THE IONOSPHERE
Bradford J. Bolfing Oct. 1971 68 p refs
(Contract F19628-71-C-0013; AF Proj. 4643)
(AD-736450; UILU-ENG-71-2551; AFCRL-71-0544; SR-1; TR-44) Avail: NTIS CSCL 20/14

HF radio waves at a number of discrete frequencies from WWV in Ft. Collins, Colorado have been studied in order to determine the dependence of Maximum usable frequency (MUF) on electron content and slab thickness. MUF is determined using skip phenomena of the WWV signal for the Ft. Collins - Danville path (1460 km). Electron content is measured at Urbana, Illinois and at Sioux City, Iowa near the midepoint of the path. f(0)F2 (from Wallops Island) data are used to determine slab thickness. Author (GRA)

N72-22151# Michigan Univ., Ann Arbor. Radiation Lab.
TECHNIQUES FOR BROADBAND CONTROL OF RADAR CROSS SECTIONS
Valdis V. Liepa and E. Lawrence McMahon Sep. 1971 56 p refs
(Contract F19628-68-C-0071; AF Proj. 5635)
(AD-736420; Rept-013630-8-T; AFCRL-71-0500; SR-11) Avail: NTIS CSCL 17/9

Methods of realizing the load impedance required for radar cross section control of conducting bodies are discussed. It is shown that passive loading, using frequency-dependent dielectric/magnetic materials in a radial or coaxial line, requires a frequency dependence which is not exhibited by any known material. A number of active synthesis approaches are examined, with emphasis on those using the Negative Impedance Converter (NIC). Experimental results are given for a particular NIC realization operating in the 5 - 10 MHz range; the circuit is shown to be capable of producing the load impedance required for a cross-section reduction of 13dB or more over a 2:1 bandwidth. Author (GRA)

N72-22152# Rome Air Development Center, Griffiss AFB, N.Y.
THE MEANING AND MEASUREMENT OF THROUGHPUT Final Report
John R. Lemon and John B. Evanowsky Nov. 1971 29 p ref
(AD-736416; RADC-TR-71-279) Avail: NTIS CSCL 09/4

Rome Air Development Center's Digital Communications

Experimental Facility (DICEF) has conducted a test and evaluation of the AUTOVON which has revealed the analog and digital characteristics of the system. The Digital tests incorporated various different modems and established that most of the errors occur in bursts because of the transient perturbations of the AUTOVON, and because of modem modulation and scrambling techniques. The Bit Error Rate (BER) of the digital transmission is affected by these bursts more than Throughput. Since Throughput is a measure of the actual message transfer rate of a digital system, both BER and Throughput should be measured when testing a digital system. The report discusses the importance of Throughput and its relationship to BER, how Throughput is measured, and construction of a device to aid Throughput measurements. Author (GRA)

N72-22153# Alaska Univ., College. Inst. of Arctic Environmental Engineering.

REFLECTION OF mm WAVES FROM SNOW AND SEA ICE Semiannual Technical Report, 1 Jun. 1971 - 31 Jan. 1972

William M. Sackinger and Robert C. Byrd 31 Jan. 1972 109 p refs

(Contract N00014-71-A-0365-0001; ARPA Order 1783)

(AD-736593; IAEE-7203) Avail: NTIS CSCL 17/9

The report relates to utility of imaging radars for arctic surface guidance. The program involves field measurements of backscatter from snow, ice and sea ice for a wide variety of meteorological and surface conditions. Laboratory measurements of the complex dielectric constant are presented also, to enable the separation of the roughness contribution to the backscatter. During the first seven months of the program, the dielectric properties of sea ice were measured in the laboratory from 36 to 40 GHz, over a representative range of temperatures, salinities, and orientation. The real part of the dielectric constant is close to 3 for most conditions, but the loss tangent can vary over three orders of magnitude, depending upon the temperature and salinity. Under most conditions, an incident wave of 1 cm wavelength would penetrate less than one meter into the sea ice. Strong distinction of freshly-formed sea ice from old sea ice appears likely. Backscatter from sea ice is currently being measured. Distinction of rough and smooth surfaces is possible, based upon preliminary interpretation of the data. Author (GRA)

N72-22154# Research Triangle Inst., Durham, N.C.

EVALUATION OF SIMMS FOR AN/SRC-20 RADIO SET Final Report, Oct. 1970 - Mar. 1971

C. A. Krohn, C. A. Clayton, and J. W. Dunn Nov. 1971 67 p refs

(Contract N00123-71-C-0168; RTI Proj. SU-603-1)

(AD-736586) Avail: NTIS CSCL 17/2

The overall purpose of this effort is to perform a comparative evaluation of the Symbolic Integrated Maintenance Manual System (SIMMS) and the conventional maintenance manual for the Naval AN/SRC-20 radio set. Data were collected from the three Naval Electronic Technician C-Schools for this equipment. This report presents the final analysis of the data. This report was approved by the Naval representatives in November, 1971. Author (GRA)

N72-22155# RCA Research Labs., Sainte Anne de Bellevue (Quebec).

RADAR BACKSCATTER STUDIES Technical Report, 6 Oct. 1970 - 20 Jun. 1971

Issie P. Shkarofsky, Asoke K. Ghosh, and E. Noel Almey Jul. 1971 154 p refs

(Contract F04701-70-C-0196)

(AD-736020; PSP-103; SAMSO-TR-71-253) Avail: NTIS CSCL 17/9

The document refers to the results of a program aimed at improving knowledge of the scattering of electromagnetic waves from turbulent plasma jet. Chapter I covers the task on the theory-experiment comparison of the backscattered data obtained last year. Several theoretical models are developed and applied to compare with the experimental results. In Chapter II, an experimental technique is provided to measure the modification of the electromagnetic field in turbulent plasma. Measurements are made for both direct and cross polarized fields for a range of density from underdense to near critical. Author (GRA)

N72-22156# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

A HIGH-SPEED DIGITAL FOURIER ANALYZER

A. M. Chwastyk Jul. 1971 75 p refs

(Contract N00017-62-C-0604)

(AD-736153; APL-TG-1170) Avail: NTIS CSCL 09/2

The report describes a processor that is being used for radar and multichannel sonar spectral analysis of band-limited input signals. Its design is based on a shift register implementation of a fast Fourier transform algorithm coupled with a single flow-through arithmetic unit. It is one of the fastest systems in operation, and is capable of transforming 4096 complex input data samples in less than 12 ms. Speed is obtained by using an organization that performs the rapid data reordering required for execution of the algorithm. A post-processing unit is used to increase the quality of estimation of line spectra in statistically short term spectra. The unit can be used either as an integrator or as a first order recursive filter. It is implemented in a floating point format to maintain its dynamic range. Hardware is kept to a minimum by establishing minimum and maximum ratios of the two signals required in the recursive filter computation. Author (GRA)

N72-22157# Army Electronics Command, Fort Monmouth, N.J.

BINOMIAL PULSE GENERATORS

William A. Stirrat Dec. 1971 29 p

(DA Proj. 1H6-62701-D-449)

(AD-736368; ECOM-3521) Avail: NTIS CSCL 14/2

The report describes a study of analog and digital synthesis of the binomial pulse. The factors to be considered in the design and the implications of departure from the ideal are determined. Specifications are developed for routine design and construction of a digital synthesizer that produces a 1 microsecond radar pulse having a 1 k HZ repetition rate. Author (GRA)

N72-22158# Navy Electronics Lab., San Diego, Calif.

A PARAMETRIC STUDY OF EXTREMELY LOW FREQUENCY (ELF) PROPAGATION UNDER ANISOTROPIC DIFFUSE IONOSPHERES

Herbert G. Hughes, William F. Moler, and Linda R. Shockey 1 Nov. 1971 90 p refs

(NEL Proj. 721)

(AD-736227; NEL-721) Avail: NTIS CSCL 20/14

The report presents results of a numerical study of EM propagation under diffuse anistropic ionospheres at the extremely low frequencies of 45 Hz and 75 Hz. Waveguide mode parameters are presented under both day and night ambient conditions for several values of ground conductivity as a function of geomagnetic flux density, dip angle, and direction of propagation. Author (GRA)

N72-22159# Air Force Cambridge Research Labs., L. G. Hanson Field, Mass.

ESTIMATION OF THE CUMULATIVE AMPLITUDE PROBABILITY DISTRIBUTION FUNCTION OF IONOSPHERIC SCINTILLATIONS

Herbert E. Whitney, Jules Aarons, and Douglas R. Seemann 7 Oct. 1971 41 p refs

(AF Proj. 4643)

(AD-736405; AFCRL-71-0525; AFCRL-ERP-373) Avail: NTIS CSCL 20/14

The fading characteristics of ionospheric scintillations can be precisely described by a cumulative amplitude probability distribution function (cdf). The cdf expresses the probability or percentage of time that the signal amplitude will equal or exceed a given amplitude. Utilizing ionospheric scintillations observed on

beacon signals from synchronous satellites transmitting at 136 MHz, distributions of amplitude variations have been made. The resulting distributions have been divided into five groups corresponding to ranges of scintillation index, the predominant measure in scintillation studies. The five distribution models are then combined with the occurrence of scintillations in various index ranges to produce cumulative amplitude probability distributions. These have been done for long term observations made at Hamilton, Mass., Narssarssuaq, Greenland, and Huancayo, Peru. The resulting data allows engineers to determine margins necessary for communication and navigation systems.

Author (GRA)

N72-22160# Air Force Cambridge Research Labs., L. G. Hanson Field, Mass. Aeronomy Lab.

A STUDY OF THE SCATTERING OF MICROWAVES BY A STRATIFIED OVERDENSE PLASMA AT HIGH COLLISION FREQUENCIES Interim Report

Milton M. Klein 27 Jul. 1971 20 p refs

(AF Proj. 7635)

(AD-736795; AFCRL-71-0400; ERP-364) Avail: NTIS CSCL 20/14

Knowledge, together with understanding, that pertains to the propagation of electromagnetic waves through the ionospheric irregularities, and artificial electron clouds provides the Air Force with information and criteria necessary for the solution of problems involving discrimination, detection and communication. The scattering of electromagnetic waves from clouds with a high collision frequency is an essential part of this information. For a series of density distributions, a study has been conducted of the reflection of electromagnetic waves from stratified overdense plasmas in which the ratio of collision frequency to incident frequency is large and the transmission negligible. Author (GRA)

N72-22161# National Committee for Space Research, Haifa (Israel). Radio Observatory.

IONOSPHERIC RESEARCH USING SATELLITES Annual Scientific Report, 1 Feb. - 31 Dec. 1970

Jonathan Mass, Israel Keroub, and Abraham Shuval 31 Jan. 1972 21 p refs

(Contract F61052-69-C-0017; AF Proj. 4643)

(AD-737340; AFCRL-72-0010) Avail: NTIS CSCL 20/14

A new ray-tracing program for HF waves through the ionosphere is reported. First applications were made to the study of propagation of satellite signals perpendicularly to the earth's field. The change in the sense of polarization was also measured experimentally as the satellite moves through transverse propagation conditions. The pattern and gain of a 30 foot dish antenna was measured experimentally using navigation satellite transmission on 400 MHZ and compared to calculations based on the measurement of the illumination by the specially designed feed. Author (GRA)

N72-22172# Philco-Ford Corp., Willowgrove, Pa.

PHOTOTRANSMISSION AND VIDEO STORAGE

Richard Schaphorst *In* AGARD Image Storage and Transmission Systems for the Dissemination of Inform. Feb. 1972 12 p refs (See N72-22168 13-08)

Avail: NTIS

N72-22395# Centre National d'Etudes des Telecommunications, Issy-les-Moulineaux (France).

AN ACTIVE RADIOWAVE EMISSION EXPERIMENT

M. Petit *In* ESRO The ESRO Geostationary Magnetospheric Satellite Mar. 1971 p 201-212 refs (See N72-22377 13-13)

Avail: NTIS

N72-22397# European Space Research and Technology Center, Noordwijk (Netherlands). Satellites and Sounding Rockets Dept.

THE GEOSTATIONARY SATELLITE TELEMETRY SYSTEM

W. Lothaller *In* ESRO The ESRO Geostationary Magnetospheric Satellite Mar. 1971 p 223-229 (See N72-22377 13-13)

Avail: NTIS

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics

N72-22162* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

DATA MULTIPLEXER USING TREE SWITCHING CONFIGURATION Patent

Richard A. Easton and Edward E. Hilbert, inventors (to NASA) Issued 19 Oct. 1971 9 p Filed 5 Oct. 1970 Sponsored by NASA

(NASA-Case-NPO-11333; US-Patent-3,614,327;

US-Patent-Appl-SN-78065; US-Patent-Class-179-15A;

US-Patent-Class-179-15BL; US-Patent-Class-178-52;

US-Patent-Class-328-104; US-Patent-Class-328-154;

US-Patent-Class-307-243; US-Patent-Class-307-251) Avail: US Patent Office CSCL 09B

A data multiplexer is described in which field effect transistors are arranged in a tree switching configuration of n columns and are driven by n drivers to control the multiplexing of data from 2 to the nth power sources. Each column of field effect transistors is controlled by a different driver which has two outputs. Only when the driver is clocked are the field effect transistors able to operate. In the absence of a clock pulse all field effect transistors are in the off condition. Serial-parallel redundancy of the field effect transistors and their drivers is used to increase reliability. Official Gazette of the U.S. Patent Office

N72-22163* Gulton Industries, Inc., Albuquerque, N.Mex.

ANALOG-TO-DIGITAL CONVERTER Patent

Wallace R. Finley and Jay A. Cox, inventors (to NASA) Issued 19 Oct. 1971 5 p Filed 27 Mar. 1970 Supersedes N70-36077 (08 - 19, p 3510) Sponsored by NASA

(NASA-Case-MSC-13110-1; US-Patent-3,614,772;

US-Patent-Appl-SN-23132; US-Patent-Class-340-347AD) Avail: US Patent Office CSCL 09B

An analog-to-digital converter which utilizes an offset voltage to eliminate problems of offset errors is discussed. The conversion was performed on the ratio of the unknown analog signal to the offset voltage.

Official Gazette of the U.S. Patent Office

N72-22164* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

SYSTEM FOR QUANTIZING GRAPHIC DISPLAYS Patent

Nazem A. Habbal, inventor (to NASA) Issued 16 Nov. 1971 6 p Filed 21 Nov. 1969 Supersedes N70-20727 (08 - 08, p 1413) Sponsored by NASA

(NASA-Case-NPO-10745; US-Patent-3,621,130;

US-Patent-Appl-SN-878730; US-Patent-Class-178-7.2R;

US-Patent-Class-178-6.8; US-Patent-Class-178-DIG.28;

US-Patent-Class-178-DIG.36) Avail: US Patent Office CSCL 09B

A system for digitizing a graphic display to determine the position and orientation of objects is disclosed. The display is provided with a reference coordinate framework. A detection apparatus scans the display in a line-by-line manner. A counter is initiated when each line scan intersects a first reference line of the coordinate framework and normally continues to count until the scan intersects a second reference line. The counter values from each line scan are stored in a computer memory. Since the linear speed of each scan relative to the counting rate is known, information relating to the image distance above the start reference line is obtained. Information as to the image position in the orthogonal coordinate is obtained by counting the number of scans of know separation from a reference line segment to

the point where the reference scan intersects the portion of interest. Official Gazette of the U.S. Patent Office

N72-22165* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DIGITAL FUNCTION GENERATOR Patent
Marvin Perlman, inventor (to NASA) Issued 16 Nov. 1971 7 p Filed 24 Sep. 1969 Supersedes N70-25930 (08 - 12, p 2183)
Sponsored by NASA
(NASA-Case-NPO-11104; US-Patent-3,621,228; US-Patent-Appl-SN-860750; US-Patent-Class-235-197; US-Patent-Class-235-150.52; US-Patent-Class-235-150.53; US-Patent-Class-235-183; US-Patent-Class-235-194) Avail: US Patent Office CSCL 09B

A digital function generator capable of generating any arbitrary single valued function representable by an independent and a dependent variable is disclosed. A state signal generator produces a plurality of output state signals corresponding to quantized sequential values of the independent variable. Predetermined quantized sequential signals correspond to predetermined incremental values of the dependent variable. A decoder monitors the output of the state signal generator and provides an output signal corresponding to the occurrence of the predetermined quantized sequential signals. A monitor provides an output signal which varies as a function of the decoder output. A digital-to-analog converter converts the monitor output to an analog signal representative of the function.
Official Gazette of the U.S. Patent Office

N72-22166* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ANALOG-TO-DIGITAL CONVERTER ANALYZING SYSTEM Patent
Willis W. Allen, inventor (to NASA) Issued 7 Sep. 1971 13 p Filed 9 Sep. 1969 Supersedes N70-36074 (08 - 19, p 3510)
Sponsored by NASA
(NASA-Case-NPO-10560; US-Patent-3,603,772; US-Patent-Appl-SN-856282; US-Patent-Class-235-153; US-Patent-Class-324-73AT; US-Patent-Class-340-347AD) Avail: US Patent Office CSCL 09B

A system is presented in which a variable and measurable analog signal, such as a voltage, is supplied to an A/D converter. Successive digital outputs, such as numbers, of the converter are determined and temporarily stored for comparison purposes. Based on the relative values of the successive numbers, the input voltage to the converter is varied, both in polarity and in magnitude, until a voltage is reached, which when applied to the converter. There exists a 50 percent probability that the output number is one of two adjacent numbers. The voltage magnitude, is recorded to represent one indecision zone. Thereafter, the input voltage is varied to determine another indecision zone between a selected output number and another number. Offical Gazette of the U.S. Patent Office

N72-22167* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FEEDBACK SHIFT REGISTER WITH STATES DECOMPOSED INTO CYCLES OF EQUAL LENGTH Patent
Marvin Perlman, inventor (to NASA) Issued 28 Sep. 1971 8 p Filed 22 Oct. 1969 Supersedes N70-22205 (08 - 09, p 1611)
Sponsored by NASA
(NASA-Case-NPO-11082; US-Patent-3,609,327; US-Patent-Appl-SN-868529; US-Patent-Class-235-152; US-Patent-Class-340-146.1; US-Patent-Class-340-348) Avail: US Patent Office CSCL 09B

A feedback shift register comprising a shift register of n stages, with the outputs of selected stages being mod-2 added in a feedback unit is described. The complement of the unit is fed back to the register's input stage. The number of outputs, which are fed back, is always odd, equaling a number which is one less than 2, raised to a number representing the number of 1's in the binary representation of n. The actual stages which are fed back are defined by the exponents of the terms X in the expansion of the term (X+1) to the n powers.
Offical Gazette of the U.S. Patent Office

N72-22168# Advisory Group for Aerospace Research and Development, Paris (France).
IMAGE STORAGE AND TRANSMISSION SYSTEMS FOR THE DISSEMINATION OF INFORMATION
Feb. 1972 44 p refs Conf. Proc. Presented at Joint Meeting, Oslo, 9 Sep. 1971
(AGARD-CP-92) Avail: NTIS

Advanced systems of data processing are presented which involve the storage, retrieval, transmission, and reproduction of alphanumeric and pictorial data. Emphasis is placed on techniques of image conversion and display processes utilizing microfilms. For individual titles, see N72-22169 through N72-22173.

N72-22169# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
AN EXPERIMENTAL TEXT-ACCESS SYSTEM
Donald R. Knudson *In* AGARD Image Storage and Transmission Systems for the Dissemination of Inform. Feb. 1972 9 p refs Sponsored in part by NSF (See N72-22168 13-08)
Avail: NTIS

A system is described which was designed to provide remote access to 90,000 pages of microfilm storage. It is part of a computer-oriented model library for conducting user experiments with two types of library retrieval; one provides access to the computer-stored catalog data for a group of selected documents and the second provides access to the microfilmed text of those documents. The text-access system automatically retrieves, scans, and transmits requested pages to remote display terminals utilizing a wideband transmission network. The current system employs two types of image-storage devices: a direct-view storage tube and a photographic camera. The microfilm images are scanned by a flying-spot scanner, and the scan-line density and sweep rates are varied to accommodate the limitations imposed by the different display terminals. A single coaxial cable path links the terminals to each other and to the central scanning station. Video signals are preceded by encoded digital messages containing a terminal address and commands for controlling terminal functions. A combined catalog/text terminal was developed which displays either the digitally-encoded catalog data or the text video signal on the same cathode-ray tube. The text display electronics were added to a commercially available computer terminal utilizing a storage-tube display to provide access to both catalog and text from a single terminal. Author

N72-22170# Internationale Dokumentationsgesellschaft fuer Chemie m.b.H., Frankfurt am Main (West Germany).
COMPUTER AIDED INPUT OF GRAPHIC INFORMATION BY KEYBOARDING UNDER VISUAL CONTROL OF DISPLAY AS APPLIED TO CHEMICAL STRUCTURES
Hans-Stefan Neubert *In* AGARD Image Storage and Transmission Systems for the Dissemination of Inform. Feb. 1972 6 p (See N72-22168 13-08)
Avail: NTIS

A method is described, using computer supported keyboards with graphic displays, for processing and storing structural formulae of chemical compounds. By keyboarding the formula the graphic information is stored and the figure appears on the screen where it can be verified visually and if necessary the input can be corrected. The proposed computer configuration allows the simultaneous input from 16 terminals. Author

N72-22171# National Physical Lab., Teddington (England). Information Systems Branch.
PACKET-SWITCHING NETWORK
D. L. A. Barber *In* AGARD Image Storage and Transmission Systems for the Dissemination of Inform. Feb. 1972 12 p refs (See N72-22168 13-08)
Avail: NTIS

High speed store-and-forward packet-switching techniques are proposed as an alternative to the use of the public telephone network by remote access computing systems. The type of traffic generated when computer systems react with human beings and with each other is examined, and it is shown why the use of the

telephone network has drawbacks. Packet-switching is demonstrated to be more appropriate for handling such traffic, and some existing and projected packet-switching schemes are described. The effect these schemes may have on the development of future computing systems is considered, both in respect of computer and terminal development. Author

N72-22172# Philco-Ford Corp., Willowgrove, Pa.
PHOTOTRANSMISSION AND VIDEO STORAGE c07
Richard Schaphorst *In* AGARD Image Storage and Transmission Systems for the Dissemination of Inform. Feb. 1972 12 p refs (See N72-22168 13-08)
Avail: NTIS

Four advanced digital visual communication systems for transmitting animated television, single frame television, and facsimile are described in detail. The utilization of a video disc recorder for efficient storage of television images is discussed in application to the single frame TV system. The Digitel System designed for transmission over wideband circuits at 40 million bits/second provides high quality, fully animated color television service. The frame-to-frame Delta coding system operates at 16 million bits/second for digital transmission over conventional 5 MHz video circuits. The Vidicoder System stores TV pictures on a video disc recorder and provides for the digital transmission of a TV frame from one storage device to another up to 1 million bits/second. The Fastfax is a facsimile equipment which digitally transmits black/white and gray scale photographs over any communication channel up to 50 million bits/second. The four systems employ different picture coding and data compression techniques. DIGITEL employs two-bit Differential PCM; the Frame-to-Frame Delta System transmits brightness changes relative to a stored reference picture; the VIDICODER utilizes run length coding and bit plane coding; and the FASTFAX equipment employs run length coding and zero order interpolation processing. The relative performance and compression factors of these coding techniques are analyzed. Author

N72-22173# British Overseas Airways Corp., London (England).
PLANNING AND DEVELOPMENT OF COMPUTER OUTPUT ON MICROFILM FOR A COMMERCIAL APPLICATION
B. S. Harris *In* AGARD Image Storage and Transmission Systems for the Dissemination of Inform. Feb. 1972 8 p (See N72-22168 13-08)
Avail: NTIS

The computer/communications structure in a well-dispersed international organization are outlined, and a specific examination is made of the computer output to microfilm technique. The equipment used is described, principles of operation examined, and current and future applications discussed. Author

N72-22174# National Aerospace Lab., Tokyo (Japan).
MODIFIED OPTIMIZATION ALGORITHM FOR COMPUTER STORAGE PROBLEMS IN A GENERALIZED NEWTON-RAPHSON METHOD
Toru Shiho Oct. 1971 22 p refs In JAPANESE; ENGLISH summary
(NAL-TR-149) Avail: NTIS

A modified algorithm for the generalized Newton-Raphson method (or quasi-linearization) is proposed, which eliminates the necessity of computer memory storage. A generalized Newton-Raphson algorithm was reformed by introducing the concepts of quasi-reference and transition matrix, and by trading the memory storage for computation time. This reformation eliminates most of the computer memory storage and also improves computational speed for optimization problems in control theory. Author

N72-22175*# Stanford Univ., Calif. Inst. for Mathematical Studies in the Social Sciences.
INSTRUCT CODERS' MANUAL
Jamesine Friend 1 May 1971 107 p
(Grants NGR-05-020-244; OE-G-0-70-4797(607))
(NASA-CR-126146; SU-TR-172) Avail: NTIS CSCL 09B

A manual designed both as an instructional manual for beginning coders and as a reference manual for the coding language INSTRUCT, is presented. The manual includes the major programs necessary to implement the teaching system and lists the limitation of current implementation. A detailed description is given of how to code a lesson, what buttons to push, and what utility programs to use. Suggestions for debugging coded lessons and the error messages that may be received during assembly or while running the lesson are given. E.H.W.

N72-22176*# Stanford Univ., Calif. Inst. for Mathematical Studies in the Social Sciences.
COMPUTER-ASSISTED INSTRUCTION IN PROGRAMMING: AID
Jamesine Friend and R. C. Atkinson 25 Jan. 1971 80 p
(Grant NGR-05-020-244)
(NASA-CR-126156; SU-TR-164) Avail: NTIS CSCL 09B

Lessons for training students on how to program and operate computers to and AID language are given. The course consists of a set of 50 lessons, plus summaries, reviews, tests, and extra credit problems. No prior knowledge is needed for the course, the only requirement being a strong background in algebra. A student manual, which includes instruction for operating the instructional program and a glossary of terms used in the course, is included in the appendices. E.H.W.

N72-22177# Committee on Government Operations (U. S. House).
AUTOMATIC DATA PROCESSING
Washington GPO 1972 284 p refs Hearing before Comm. on Govt. Operations, 92d Congr., 1st Sess., 20 May 1971
Avail: Subcomm. on Govt. Activities

A hearing before the Committee on Government Operations concerning the development, control, and application of automatic data processing equipment is presented. The requirement for the United States to maintain its superiority in the electronic computer field is supported by testimony from various manufacturers and operators of computer equipment. The allocation of funds to provide automatic data processing equipment for government policymakers and the authorization of funds for additional computer technology research are discussed. Author

N72-22178*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN IMPROVED MULTIPLE LINEAR REGRESSION AND DATA ANALYSIS COMPUTER PROGRAM PACKAGE
Steven M. Sidik Washington Apr. 1972 97 p refs
(NASA-TN-D-6770; E-6718) Avail: NTIS CSCL 09B

NEWRAP, an improved version of a previous multiple linear regression program called RAPIER, CREDUC, and CRSPLT, allows for a complete regression analysis including cross plots of the independent and dependent variables, correlation coefficients, regression coefficients, analysis of variance tables, t-statistics and their probability levels, rejection of independent variables, plots of residuals against the independent and dependent variables, and a canonical reduction of quadratic response functions useful in optimum seeking experimentation. A major improvement over RAPIER is that all regression calculations are done in double precision arithmetic. Author

N72-22179*# M&S Computing, Inc., Huntsville, Ala.
FLIGHT PROGRAM LANGUAGE REQUIREMENTS. VOLUME 1: EXECUTIVE SUMMARY Final Report
7 Mar. 1972 29 p refs 3 Vol.
(Contract NAS8-26990)
(NASA-CR-123571; Rept-72-0005-Vol-1) Avail: NTIS CSCL 09B

The activities and results of a study for the definition of flight program language requirements are described. A set of detailed requirements are presented for a language capable of supporting onboard application programming for the Marshall

Space Flight Center's anticipated future activities in the decade of 1975-85. These requirements are based, in part, on the evaluation of existing flight programming language designs to determine the applicability of these designs to flight programming activities which are anticipated. The coding of benchmark problems in the selected programming languages is discussed. These benchmarks are in the form of program kernels selected from existing flight programs. This approach was taken to insure that the results of the study would reflect state of the art language capabilities, as well as to determine whether an existing language design should be selected for adaptation.

Author

N72-22180*# M&S Computing, Inc., Huntsville, Ala.
FLIGHT PROGRAM LANGUAGE REQUIREMENTS. VOLUME 2: REQUIREMENTS AND EVALUATIONS Final Report
7 Mar. 1972 214 p refs 3 Vol.
(Contract NAS8-26990)
(NASA-CR-123570; Rept-72-0005-Vol-2) Avail: NTIS CSCL 09B

The efforts and results are summarized for a study to establish requirements for a flight programming language for future onboard computer applications. Several different languages were available as potential candidates for future NASA flight programming efforts. The study centered around an evaluation of the four most pertinent existing aerospace languages. Evaluation criteria were established, and selected kernels from the current Saturn 5 and Skylab flight programs were used as benchmark problems for sample coding. An independent review of the language specifications incorporated anticipated future programming requirements into the evaluation. A set of detailed language requirements was synthesized from these activities. The details of program language requirements and of the language evaluations are described.

Author

N72-22181# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.
THE USE OF DECISION TABLES IN BABEL
R. S. Scowen Dec. 1971 25 p refs
(NPL-NAC-8) Avail: NTIS

A description of how to use decision tables in the KDF9 Eldon implementation of BABEL is given. It summarizes the basic concepts of decision tables and defines the rules for writing and using a decision table in a BABEL program. There are a number of examples, including a complete program to calculate the cost of any telephone call in Britain.

Author (ESRO)

N72-22182# Royal Aircraft Establishment, Farnborough (England). Mathematics Dept.
THE RAE 1907 SOFTWARE LIBRARY SYSTEM
Patricia Grey-Wilson and Jennifer L. A. Warren Jun. 1971 59 p
(RAE-TM-MATH-7105; BR-26571) Avail: NTIS

The creation and maintenance of the magnetic tape and disc library system used on the 1907 computer are described.

Author (ESRO)

N72-22183# Royal Aircraft Establishment, Farnborough (England).
THE IMPLEMENTATION OF ACCOUNTING FOR PROGRAMS RUN ON THE 1907 COMPUTER AT RAE FARNBOROUGH
Irene M. Cummings Mar. 1971 61 p refs
(RAE-TM-MATH-7007; BR-25414) Avail: NTIS

The method of producing accounts for all jobs run on the ICL 1907 computer is described, as well as the actual accounting program.

Author (ESRO)

N72-22184# Posterijen, Telegrafie en Telefonie, The Hague (Netherlands).
INTRODUCTION TO INFORMATION RETRIEVAL FOR LIBRARY AND DOCUMENTATION SYSTEMS [INLEIDING TOT INFORMATION RETRIEVAL TEN BEHOEVE VAN BIBLIOTHEEK- EN DOCUMENTATIESYS TEMEN]
P. A. Kallenbach NIDER 1970 61 p refs In DUTCH
(NIDER-Publ-418) Avail: NTIS

A survey is presented of the techniques for organizing and structuring document references for library and documentation computerized information retrieval. The properties and applicability of different widening languages, and the possibilities of automatic indexing are discussed. Existing manual retrieval systems and their search logic are surveyed. The principles of record and file structure for computer storage of document references, and addressing techniques are shown. File systems for library applications, including the inverted file system, are mentioned.

ESRO

N72-22185# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OUTPUT RECORDER FOR COSMIC RAY STATIONS
A. L. Yanchukovskii, V. N. Medvendev, and A. A. Luzov 4 Nov. 1971 8 p refs Transl. into ENGLISH from Kosmicheskie Luch: (USSR), no. 11, 1969 p 170-172
(AD-736502; FTD-HT-23-282-71) Avail: NTIS CSCL 09/2

The multichannel recording system described in this article is designed to store information having a statistical distribution law and to feed results to digital printout and perforation equipment. The system is one of a class of highly specialized computers distinguished by specific features in its technical design which ensure an advanced degree of operational reliability, multicycle structuring of the entire system, full-current data writing and readout in the storage, redundancy coding for constancy in the working modes of the majority of the system's components, and the possibility of on-line error detection, individual component standardization, etc. The use of preliminary computation, which normally takes place during the recording of cosmic ray variations, results in no information loss.

Author (GRA)

N72-22186# National Bureau of Standards, Washington, D.C.
A SEARCH AND RESCUE SIMULATION MODEL FOR THE UNITED STATES COAST GUARD. VOLUME 1: EXECUTIVE LEVEL DOCUMENTATION
R. T. Penn, Jr. and W. G. Leight 18 Jun. 1971 33 p Sponsored by US Coast Guard
(NBS Proj. 4314561)
(AD-735406; NBS-10430-Vol-1) Avail: NTIS CSCL 06/7

An inter-disciplinary team, comprised of members of the staff of the Technical Analysis Division of the Bureau of Standards and representatives of the U.S. Coast Guard, has developed a Search and Rescue Simulation Model (SARSIM). Actual or projected values are used for such parameters as location of Coast Guard stations; types, deployments and capabilities of resources; manning levels; case loads; and resource assignment policies. Computer runs of the model can then provide rapid and realistic simulations of the Search and Rescue (SAR) process, supplying as output appraisals of the degree to which satisfactory service is provided, utilization of individual resources and resource types, average length of time for cases awaiting service, etc. SARSIM thus represents a powerful managerial tool with which Coast Guard planners and decision makers can economically and expeditiously explore the likely effects of proposed major changes in allocation or mode of operation.

Author (GRA)

N72-22187# National Bureau of Standards, Washington, D.C.
A SEARCH AND RESCUE SIMULATION MODEL FOR THE UNITED STATES COAST GUARD. VOLUME 2: ANALYST LEVEL DOCUMENTATION
S. S. Karp and M. D. Maltese Jun. 1971 178 p refs
(NBS Proj. 4314561)

(AD-735407; NBS-10431-Vol-2) Avail: NTIS CSCL 06/7

SARSIM is a highly flexible, user-oriented model. It simulates Coast Guard response to an input caseload scenario, i.e., people and/or property in distress. The automatic summary output from the model (e.g., response times, resource utilization statistics, etc.) gives the user considerable insight for judging the effectiveness of the SAR system with regard to each input scenario. The user is offered a variety of modes in which to operate the model. For example, he can prepare, automatically, a multitude of client demand scenarios. He can perturb the SAR resource inventory, i.e., vary the number and classes of resources, their physical capabilities, their deployment (location), and manning levels. He may also choose to exercise the model with different server disciplines (resource assignment schemata). In addition, the user can supply criteria to be applied to the simulated case history output for additional optional analysis. Author (GRA)

N72-22188# National Bureau of Standards, Washington, D.C.
A SEARCH AND RESCUE SIMULATION MODEL FOR THE UNITED STATES COAST GUARD. VOLUME 3: PROGRAMMER LEVEL DOCUMENTATION FOR PREPROCESSOR
S. S. Karp, L. K. Cummings, M. D. Maltese, and A. L. Weber Jun. 1971 98 p
(NBS Proj. 4314561)
(AD-735413; NBS-10432-Vol-3) Avail: NTIS CSCL 06/7

The volume is one of a series which documents a Search and Rescue Simulation Model for the United States Coast Guard. The report discusses the programmer level documentation for PREPROCESSOR. GRA

N72-22189# National Bureau of Standards, Washington, D.C.
A SEARCH AND RESCUE SIMULATION MODEL FOR THE UNITED STATES COAST GUARD. VOLUME 6: PROGRAMMER LEVEL DOCUMENTATION FOR OPSIM
P. L. B. Saunders and E. C. Leyendecker Jun. 1971 143 p refs
(NBS Proj. 4314561)
(AD-735414; NBS-10433-Vol-4) Avail: NTIS CSCL 06/7

The volume is one of a series which documents a Search and Rescue Simulation Model for the United States Coast Guard. The report discusses programmer level documentation for OPSIM. Author (GRA)

N72-22190# National Bureau of Standards, Washington, D.C.
A SEARCH AND RESCUE SIMULATION MODEL FOR THE UNITED STATES COAST GUARD. VOLUME 5: PROGRAMMER LEVEL DOCUMENTATION FOR POST-PROCESSOR
W. Elliott and S. S. Karp Jun. 1971 61 p Sponsored by US Coast Guard
(NBS Proj. 4314561)
(AD-735415; NBS-10434-Vol-5) Avail: NTIS CSCL 06/7

In order to examine the voluminous amount of data generated by a complex simulation such as SARSIM, an efficient post-processor is a definite requirement. The reader is reminded that the Standard Output display (from OPSIM) is given for each run of OPSIM. The OPSIM Section explains this output and the calculations. The processing of data other than that presented in the Standard Output is an option to the SARSIM user. To explain further, it is recalled that the Standard Output consists mostly of summary statistics on resource and station utilizations derived and output in several ways. Author (GRA)

N72-22191# National Bureau of Standards, Washington, D.C.
A SEARCH AND RESCUE SIMULATION MODEL FOR THE UNITED STATES COAST GUARD. APPENDIX A: FLOW CHARTS FOR PROGRAMMER LEVEL DOCUMENTATION
1971 115 p
(NBS Proj. 4314561)
(AD-735416; NBS-10435-App-A) Avail: NTIS CSCL 06/7

The volume is one of a series which documents a Search and Rescue Simulation Model for the United States Coast Guard. The report discusses the flow charts for programmer level documentation. Author (GRA)

N72-22192# National Bureau of Standards, Washington, D.C.
A SEARCH AND RESCUE SIMULATION MODEL FOR THE UNITED STATES COAST GUARD. APPENDIX B: PROGRAM LISTINGS FOR PROGRAMMER LEVEL DOCUMENTATION
1971 219 p
(NBS Proj. 4314561)
(AD-735417; NBS-10436-App-B) Avail: NTIS CSCL 06/7

The volume is one of a series which documents a Search and Rescue Simulation Model for the United States Coast Guard. The report gives program listings for programmer level documentation. Author (GRA)

N72-22193# Stanford Univ., Calif. Electronics Labs.
A COMPUTER PROGRAM FOR DYNAMIC SPECTRUM ANALYSIS APPLIED TO VLF RADIO PHENOMENA WITH EXAMPLES AND COMPARISONS TO RAYSPAN RESULTS
Michael D. Cousins Nov. 1971 52 p refs
(Contract N00014-67-A-0112-0012)
(AD-736200; SU-SEL-71-056; TR-3432-1) Avail: NTIS CSCL 09/2

A computer program is described which samples single channel analog input data and transforms the resultant time series in short segments using Fourier analysis to produce a computed spectrogram. The use of the program which operates on the Sigma-5 computer is discussed; it uses specialized peripheral devices at that facility. Examples of the operation of the program and results of its application to the spectrum analysis of VLF radio phenomena (whistlers and artificially stimulated emissions) are presented. Comparisons with typical rayspan spectra of VLF data are also shown. Author

N72-22194# Mitre Corp., Bedford, Mass.
AIDS USERS' MANUAL
C. A. Marcus Aug. 1971 92 p refs
(Contract F19628-71-C-0002; AF Proj. 4060)
(AD-736415; MTR-2203; ESD-TR-71-383) Avail: NTIS CSCL 09/2

AIDS is a computer software package designed to provide data management capabilities to a wide variety of users. It is written primarily in COBOL and is designed and implemented on the Honeywell G-635. This system, originally developed for NASA by General Electric Co., Apollo Systems Division, was named Manned Space Flight-Data Processing System (MSF-DPS). Modifications were made to improve the capabilities of MSF-DPS. These modifications, designed to meet interim requirements of the Air Force Data Services Center (AF/ACS), provide a responsive, versatile data management system for users of Honeywell (GE) 600 series computers. This technical report, designed for users of AIDS, details the features of this system and provides examples of its use. Detailed system description (installation, maintenance, internal linkages, etc.) are not contained in this report. Author (GRA)

N72-22261*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EXPERIMENTAL DETERMINATION OF STICKING COEFFICIENTS
E. E. Klingman *In its* Space Simulation 1972 p 181-192 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 09B

N72-22398# Centre National d'Etudes des Telecommunications, Issy-les-Moulineaux (France).
THE SCIENTIFIC VALUE OF COMPUTING FACILITIES FOR ESRO SATELLITE MISSIONS
F. DuCastel *In* ESRO The ESRO Geostationary Magnetospheric

Satellite Mar. 1971 p 231-236 refs (See N72-22377 13-13)
Avail: NTIS

N72-22399# Centre National d'Etudes Spatiales, Bretigny-sur-Orge (France). Div. de Techniques Electroniques et Traitement de l'Information.
ONBOARD COMPUTERS, SOME TECHNICAL CONSIDERATIONS [CALCULATEURS EMBARQUES, QUELQUES CONSIDERATIONS TECHNIQUES]
J. Cazemajou *In* ESRO The ESRO Geostationary Magnetospheric Satellite Mar. 1971 p 237-248 refs In FRENCH (See N72-22377 13-13)
Avail: NTIS

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N72-22195* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
HERMETICALLY SEALED ELBOW ACTUATOR Patent
Hans F. Wuenscher, inventor (to NASA) Issued 26 Oct. 1971 5 p Filed 25 Aug. 1969 Supersedes N70-12623 (08 - 02, p 0261)
(NASA-Case-MFS-14710; US-Patent-3,614,899;
US-Patent-Appl-SN-852843; US-Patent-Class-74-105) Avail: US Patent Office CSCL 09A

A hermetically sealed elbow actuator comprising first and second pairs of pivotally connected angular actuating elements arranged between a base member and a head member is described. The base member houses a motor that forces incremental deflection of the actuating elements and the head member through a system of drive rods and expandable linkages. Limited deflection of each pair of actuating elements permits all of the moving parts, including the motor, to be hermetically sealed by a metallic bellows since the deflection of each pair of actuating elements is small enough to be within the bending tolerance of the bellows.
Official Gazette Of the U.S. Patent Office

N72-22196* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SATURATION CURRENT PROTECTION APPARATUS FOR SATURABLE CORE TRANSFORMERS Patent
Francis C. Schwarz, inventor (to NASA) Issued 19 Oct. 1971 9 p Filed 1 Jul. 1970 Continuation-in-part of US Patent Appl. SN-775870, filed 14 Nov. 1968
(NASA-Case-ERC-10075-2; US-Patent-3,614,587;
US-Patent-Appl-SN-775870; US-Patent-Class-321-2;
US-Patent-Class-321-14; US-Patent-Class-321-19;
US-Patent-Class-321-25; US-Patent-Class-323-56;
US-Patent-Class-323-89C) Avail: US Patent Office CSCL 09A

A saturation current protection apparatus for saturable core transformers is described. A cut core (airgap) transformer detects the occurrence of rapidly increasing magnetic current in the saturable core transformer. When a rapidly increasing current condition occurs, the cut core transformer applies a suitable signal to a switching means. The switching means terminates the application of current to the saturable core transformer to protect it from an undesirable over current condition.
Official Gazette of the U.S. Patent Office

N72-22197* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PULSE COUPLING CIRCUIT Patent
Janis M. Niedra, inventor (to NASA) Issued 12 Oct. 1971 8 p Filed 11 Aug. 1969 Supersedes N70-11243 (08 - 01, p 0069)
(NASA-Case-LEW-10433-1; US-Patent-3,612,895;
US-Patent-Appl-SN-849106; US-Patent-Class-307-88MP;
US-Patent-Class-307-262) Avail: US Patent Office CSCL 09A

A switch, such as a transistor, is interposed between a pulse generator and a winding of an inductor, with a load being coupled to the inductor. The switch isolates the inductor from the pulse generator at the end of each pulse causing a partial cycle L-C oscillation in the inductor to reset its core. A capacitor may be connected across the inductor winding. To dissipate some energy, a resistor is connected in series with the capacitor. The voltage across the inductor winding is limited by a diode and a zener diode serially connected across the winding. Critical damping of the L-C oscillation is obtained by connecting the resistor and the capacitor in parallel with the zener diode. Two such circuits are doubled up in back-to-back relationship to energize two individual loads or one single load.
Official Gazette of the U.S. Patent Office

N72-22198* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SHIELDED FLAT CABLE Patent
Wilhelm Angele and Bobby W. Kennedy, inventors (to NASA) Issued 12 Oct. 1971 8 p Filed 13 Oct. 1970 Continuation-in-part of US Patent Appl. SN-723488, filed 23 Apr. 1968
(NASA-Case-MFS-13687-2; US-Patent-3,612,743;
US-Patent-Appl-SN-80369; US-Patent-Class-174-36;
US-Patent-Class-174-106R; US-Patent-Class-174-117FF) Avail: US Patent Office CSCL 09A

A flat conductor cable having multiple-ribbonlike conductors in spaced, parallel arrangement in a flat strip of insulating material is coated with a layer of shielding metal such as copper by roughening the surface of the insulating strip, contacting the strip with an electroless plating bath and then with an electrolytic plating bath. Contact of the metal shield with a ground conductor is obtained by exposing a portion of one or more conductors along the length of the cable prior to plating. An outer layer of insulating materials is applied over the shielding layer. Official Gazette of the U.S. Patent Office

N72-22199* National Aeronautics and Space Administration, Washington, D.C.
FABRICATION OF SINGLE CRYSTAL FILM SEMICONDUCTOR DEVICES Patent
Donald B. Sandstrom and David E. Sawyer, inventors (to NASA) Issued 23 Nov. 1971 5 p Filed 12 Jun. 1969 Supersedes N69-31339 (07 - 17, p 3131)
(NASA-Case-ERC-10222; US-Patent-3,621,565;
US-Patent-Appl-SN-832603; US-Patent-Class-29-590) Avail: US Patent Office CSCL 09A

The fabrication of devices is considered, in which a single crystal film is formed on a growth substrate, device fabrication operations are performed on the exposed surface of the film, and the film thereafter transferred to a nonconductive base. The transfer step includes dissolution of the growth substrate and may be followed by additional device fabrication operations performed on the second side of the film
Official Gazette of the U.S. Patent Office

N72-22200* National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
PULSED EXCITATION VOLTAGE CIRCUIT FOR TRANSDUCERS Patent
Karl F. Anderson and Thomas L. Lynch, inventors (to NASA) Issued 16 Nov. 1971 6 p Filed 30 Oct. 1969 Supersedes N70-22164 (08 - 09, p 1614)
(NASA-Case-FRC-10036; US-Patent-3,621,285;
US-Patent-Appl-SN-872602; US-Patent-Class-307-237;
US-Patent-Class-328-1; US-Patent-Class-307-317;
US-Patent-Class-307-254; US-Patent-Class-328-151;
US-Patent-Class-73-88.5) Avail: US Patent Office CSCL 09E

A pulsed excitation voltage circuit for a strain gauge bridge

is disclosed using a transformer having its primary winding adapted to receive an excitation timing pulse and two secondary windings to turn on two transistor switches adapted to connect positive and negative voltage sources of equal amplitude to opposite ends of the bridge. Voltage limiting diodes are connected to output terminals to limit commonmode voltage spikes resulting from different turnon and turnoff times of the transistor switches. Each transistor switch includes a base resistor selected at time of assembly to provide substantially equal turnon times. A speedup capacitor may be used to further equalize turnon time, and a shunt capacitor may be used at the output of one switch to offset effects of unequal turnon times.

Official Gazette of the U.S. Patent Office

N72-22201* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SOLID STATE REMOTE CIRCUIT SELECTOR SWITCH Patent

Victor S. Peterson, inventor (to NASA) Issued 16 Nov. 1971 6 p Filed 30 Sep. 1970 Supersedes N71-28769 (09 - 16, p 2571)

(NASA-Case-LEW-10387; US-Patent-3,621,287; US-Patent-Appl-SN-76899; US-Patent-Class-307-241; US-Patent-Class-307-223B; US-Patent-Class-307-252J; US-Patent-Class-307-252K; US-Patent-Class-307-284; US-Patent-Class-307-304; US-Patent-Class-307-317; US-Patent-Class-328-106) Avail: US Patent Office CSCL 09A

A plurality of controlled rectifiers each associated with a respective load to be energized are provided. Gate circuitry is provided for each controlled rectifier so that each is sensitive to a control voltage that falls within certain limits. The limits are chosen to provide nonoverlapping ranges for the rectifiers. Local selector circuits each include a bias voltage source whose output falls within respective ones of the nonoverlapping ranges of the gate circuits. Switch means are provided whereby the voltage of the bias sources may be selectively applied to the gate circuits of the controlled rectifiers.

Official Gazette of the U.S. Patent Office

N72-22202* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

RF CONTROLLED SOLID STATE SWITCH Patent

Thomas B. Fryer, inventor (to NASA) Issued 16 Nov. 1971 9 p Filed 9 Oct. 1969 Supersedes N70-20726 (08 - 08, p 1418)

(NASA-Case-ARC-10136-1; US-Patent-3,621,290; US-Patent-Appl-SN-865106; US-Patent-Class-307-247; US-Patent-Class-128-2R; US-Patent-Class-128-2.1A; US-Patent-Class-307-231; US-Patent-Class-307-288; US-Patent-Class-325-29; US-Patent-Class-325-492; US-Patent-Class-340-171; US-Patent-Class-340-203) Avail: US Patent Office CSCL 09F

An electronic element, capable of presenting either a high impedance or a low impedance between a power source and an instrument, is switched from its high impedance to its low impedance state by turning on both active elements of a complementary bistable multivibrator. By momentarily short circuiting one of the two active elements of the complementary bistable multivibrator, thereby driving its two active elements from the on to the off state, the electronic element is switched back from its low impedance to its high impedance state. When off, this circuit consumes essentially zero standby power. Alternative switching circuits use symmetrical bistable multivibrators, activated by amplified and rectified transmitted pulses, to switch a gating element from its high impedance to its low impedance state, and vice versa.

Official Gazette of the U.S. Patent Office

N72-22203* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

LOAD-INSENSITIVE ELECTRICAL DEVICE Patent

Francis C. Schwarz, inventor (to NASA) Issued 16 Nov. 1971 13 p Filed 26 Mar. 1969 Supersedes N71-28902 (09 - 16, p 2572)

(NASA-Case-XER-11046; US-Patent-3,621,362; US-Patent-Appl-SN-810579; US-Patent-Class-321-2; US-Patent-Class-321-15; US-Patent-Class-321-18; US-Patent-Class-321-45; US-Patent-Class-331-117) Avail: US Patent Office CSCL 09E

A class of power converters described for supplying direct current at one voltage from a source at another voltage which includes a simple passive circuit arrangement of solid state switches, inductors, and capacitors by which the output voltage of the converter tends to remain constant in spite of changes in load. The switches are sensitive to the current flowing in the circuit and are employed to permit the charging of capacitance devices in accordance with the load requirements. Because solid state switches may be used with relatively high voltage and because of the inherent efficiency of the invention that permits relatively high switching frequencies, power supplies built in accordance with the invention, together with their associated cabling, can be substantially lighter in weight for a given output power level and efficiency of operation than systems of the prior art.

Official Gazette of the U.S. Patent Office

N72-22204* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

PRESSURE OPERATED ELECTRICAL SWITCH RESPONSIVE TO A PRESSURE DECREASE AFTER A PRESSURE INCREASE Patent

Frederick W. Gibson, inventor (to NASA) Issued 28 Sep. 1971 5 p Filed 1 Dec. 1969 Supersedes N70-35597 (08 - 19, p 3516)

(NASA-Case-LAR-10137-1; US-Patent-3,609,271; US-Patent-Appl-SN-881041; US-Patent-Class-200-81R; US-Patent-Class-200-82C) Avail: US Patent Office CSCL 09A

A pressure-operated electrical switch is discussed with means to hold the switch closed until the pressure increases to a first predetermined value and then decreases to a second predetermined value. The holding means consists of a rod pivoted at one end with a tension spring attached near the other end of the rod. The releasing means includes a pawl attached to the other end of the rod, a compression spring subjected to the pressure, a second rod with one of its ends attached to said compression spring, and with a hook on its other end to slip over said pawl and pull the pivoted rod away from the switch.

Official Gazette of the U. S. Patent Office

N72-22205*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.

METHOD AND APPARATUS FOR LIMITING FIELD-EMISSION CURRENT Patent Application

Wayne L. Lees, inventor (to NASA) Filed 11 Dec. 1970 20 p (NASA-Case-ERC-10015-2; US-Patent-Appl-SN-97343) Avail: NTIS CSCL 09E

Self-protected electrodes which inherently limit field emitted currents to a safe value and also stabilize such currents are described. The electrodes are characterized by a plurality of columnar conductors connected at one end to a common potential source. The electrodes are insulated from one another along their lengths. The effective or exposed surfaces are subdivided into a mosaic of conducting patches which are insulated from one another.

NASA

N72-22206# Aeronautical Research Labs., Melbourne (Australia).

EXPERIMENTAL INVESTIGATION OF HUMIDITY EFFECTS IN LC OSCILLATORS

N. J. Sullivan Jun. 1971 16 p refs

(ARL/F-Note-46; ISBN-642-97689-9) Avail: NTIS

The effect of changes in humidity on the frequency stability of a modified Franklin oscillator is described. This oscillator has the particular advantage that over a broad band of frequencies the frequency of oscillation is completely independent of variations in active and passive components outside the resonator. Frequency instabilities arising from humidity variations can therefore be attributed directly to changes in either the capacitance or

inductance of the resonator. A literature survey indicated some confusion as to the causes of humidity-dependent frequency variations. It is shown that such variations can be attributed directly to changes in coil self (distributed) capacitance. No measurable change in frequency with variations in humidity occurs when the inductors are hermetically sealed. Author

N72-22207*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RESEARCH ACHIEVEMENTS REVIEW. VOLUME 4, REPORT NO. 4 ELECTRICAL POWER SYSTEMS RESEARCH AT MARSHALL SPACE FLIGHT CENTER
Feb. 1972 118 p refs
(NASA-TM-X-64642) Avail: NTIS CSCL 09E

Electrical power systems and solar cells for spacecraft are considered. In addition, microwave power transmission and fuel cell performance are discussed. For individual titles, see N72-22208 through N72-22217.

N72-22208*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SKYLAB ELECTRICAL POWER SYSTEM
Roy Lanier, Jr. *In its* Res. Achievements Rev., Vol. 4, Report no. 4 Feb. 1972 p 3-11 (See N72-22207 13-09)
Avail: NTIS CSCL 09E

The Skylab electrical power system (EPS) will be composed of the parallel combination of the airlock module and the Apollo telescope mount EPS's. Each of these subsystems is capable of supplying almost 4000 W of continuous conditioned power. The operation of the two subsystems in parallel, their features, and their capabilities are discussed. Author

N72-22209*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ANALYSIS OF EFFECTS OF SHADOWED AND OPEN SOLAR CELLS ON OWS SOLAR CELL ARRAY PERFORMANCE c03
J. L. Miller *In its* Res. Achievements Rev., Vol. 4, Report no. 4 Feb. 1972 p 13-27 refs (See N72-22207 13-09)
Avail: NTIS CSCL 10A

The effect of hot spots and voltage breakdowns caused by open or shadowed cells in the orbital workshop (OWS) solar cell array is analyzed. The analysis is performed on three proposed OWS solar cell string configurations of 1, 2, and 4 cells in parallel by 154 cells in series. Under several operating conditions, at least one cell string configuration showed an excessive hot spot temperature. Author

N72-22210*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE USE OF THE SOLAR CELL DARK CHARACTERISTIC FOR CHECKOUT OF LARGE AREA SOLAR ARRAYS c03
W. L. Crabtree *In its* Res. Achievements Rev., Vol Report no. 4 Feb. 1972 p 29-35 (See N72-22207 13-09)
Avail: NTIS CSCL 10A

The dark characteristics method of checkout is described and discussed. A portion of the feasibility tests conducted and utilization in the Apollo telescope mount program are considered. Author

N72-22211*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
NICKEL-CADMIUM BATTERY AND CELL INVESTIGATION FOR APOLLO TELESCOPE MOUNT (ATM) APPLICATIONS c03
L. E. Paschal *In its* Res. Achievements Rev., Vol. 4, Report no. 4 Feb. 1972 p 37-58 ref (See N72-22207 13-09)
Avail: NTIS CSCL 10C

An investigation of the nickel-cadmium battery was conducted to determine optimum and acceptable battery performance within the ATM mission requirements. Battery performance characteristics were determined through a test program that investigated both charge control regimes, energy storage, and thermal characteristics. Author

N72-22212*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LOAD SHARING BETWEEN PARALLEL OPERATING dc POWER MODULES
Robert Kapustka *In its* Res. Achievements Rev., vol. 4, Report no. 4 Feb. 1972 p 59-61 (See N72-22207 13-09)
Avail: NTIS CSCL 09E

Electrical load sharing between dc power modules operating in parallel received attention for application in large space electrical power systems. Various approaches are discussed, with emphasis on the solution used for the Apollo telescope mount electrical power system. Author

N72-22213*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MICROWAVE POWER TRANSMISSION CONSIDERATIONS FOR EARTH ORBITAL SPACE MISSIONS c10
W. J. Robinson, Jr. *In its* Res. Achievements Rev., Vol. 4, Report no. 4 Feb. 1972 p 63-66 refs (See N72-22207 13-09)
Avail: NTIS CSCL 09C

Investigation revealed that the use of microwaves and lasers was feasible for transferring electrical power in space. The results of the study led to a consideration of microwaves for electric power transmission between earth orbital satellites in the late 70's or early 80's. Efforts to develop design information for planning purposes are discussed. K.P.D.

N72-22214*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LARGE AREA LUNAR SURFACE SOLAR ARRAY c03
J. L. Miller *In its* Res. Achievements Rev., Vol. 4, Report no. 4 Feb. 1972 p 67-76 refs (See N72-22207 13-09)
Avail: NTIS CSCL 10A

A 45-kWe solar array is described which will meet the energy requirements (10,000 to 500,000 kWh) for a 1-year lunar mission with a 3- to 6-man crew. The design requirements and potential problem areas associated with survival in the extreme thermal environment are discussed. The design, fabrication, and testing of six engineering evaluation modules are described and the design concept selected for the 1971 to 1975 time period is presented. Author

N72-22215*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THERMOELECTRIC GENERATOR TEST PROGRAMS AT MSFC c22
L. E. Young *In its* Res. Achievements Rev., Vol. 4, Report no. 4 Feb. 1972 p 77-96 refs (See N72-22207 13-09)
Avail: NTIS CSCL 18N

The results are presented for two thermoelectric generator test programs. A SNAP 19 radioisotope thermoelectric generator was evaluated, and a compact thermoelectric module, TEM-9U, is presently being studied. The SNAP-19 program consisted of a 23,687-hr thermal vacuum endurance test that revealed generator degradation effects, performance characteristics, and response to thermal cycling. Post-test inspection revealed some lead telluride couple sublimation resulting from the near vacuum final internal pressure. The TEM-9U program was begun in April 1970, and more than 6000 hr of test time have been accumulated. Tests were made to evaluate both steady state and transient performance characteristics. Computerized math models were developed that can closely predict generator thermal/electrical performance. Author

N72-22216*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
INCREASED HYDROX FUEL CELL PERFORMANCE c03

John R. Morgan *In its* Res. Achievements Rev., Vol. 4, Report no. 4 Feb. 1972 p 97-101 (See N72-22207 13-09)
Avail: NTIS CSCL 10A

Research is being conducted to identify hydrogen-oxygen fuel cell system limitations and to investigate methods of reducing them. A method is proposed for improving cathodic efficiency. Author

N72-22217*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
HIGH FREQUENCY dc-TO-dc CONVERSION
R. M. Acker *In its* Res. Achievements Rev., Vol. 4, Report no. 4 Feb. 1972 p 103-105 (See N72-22207 13-09)
Avail: NTIS CSCL 09E

An effort was initiated to standardize the circuit design, packaging, and fabrication of a push-pull dc-to-dc converter and to reduce the size and weight. By operating the converter in the frequency range of 50 to 100 kHz a reduction in size and weight can be realized. With proven circuit designs, modular packaging, and controlled fabrication techniques, a family of highly reliable dc-to-dc converters can be made available for future space programs. Author

N72-22218*# CAED Corp., La Canada, Calif.
DESIGN OF MICROSTRIP COMPONENTS BY COMPUTER
Terry C. Cisco Washington NASA Mar. 1972 266 p refs
(Contract NAS1-10521)
(NASA-CR-1982) Avail: NTIS CSCL 09E

A number of computer programs are presented for use in the synthesis of microwave components in microstrip geometries. The programs compute the electrical and dimensional parameters required to synthesize couplers, filters, circulators, transformers, power splitters, diode switches, multipliers, diode attenuators and phase shifters. Additional programs are included to analyze and optimize cascaded transmission lines and lumped element networks, to analyze and synthesize Chebyshev and Butterworth filter prototypes, and to compute mixer intermodulation products. The programs are written in FORTRAN and the emphasis of the study is placed on the use of these programs and not on the theoretical aspects of the structures. Author

N72-22219*# Princeton Univ. Observatory, N.J.
RECENT DEVELOPMENTS AND APPLICATIONS OF THE SEC VIDICON FOR ASTRONOMY
Paul Zucchino and John L. Lowrance Oct. 1971 39 p refs
(Contract NSR-31-001-127)
(NASA-CR-126144) Avail: NTIS CSCL 09E

The engineering development of the SEC vidicon as an astronomical sensor has continued in parallel with its operational use. One scientific application was the six hour exposure of the quasar PHL-957 at the Coude spectrograph of the 200-inch Hale telescope. The developmental effort includes both the enhancement of the basic attributes that make the SEC an appropriate sensor, namely, high quantum efficiency, low threshold, and long integration; as well as work to broaden its scientific usefulness, such as the development of a MgF2 photocathode window for vacuum ultraviolet sensitivity, and a permanent magnet focus design for thermal compatibility with proposed large space telescopes. Additional details on the characteristics of the SEC tube are discussed, as well as plans to make a larger and higher resolution version. Author

N72-22220*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
THERMAL PERFORMANCE AND RADIO-FREQUENCY TRANSMISSIVITY OF CANDIDATE ABLATION MATERIALS FOR S-BAND ANTENNA WINDOW APPLICATION ON MANNED SPACECRAFT
Donald J. Tillian and H. Dean Cubley Jun. 1970 78 p ref
(NASA-TM-X-68325; MSC-01274) Avail: NTIS CSCL 09E

A test program was conducted in the MSC 1.5 MW arc-heated facility to evaluate the thermal performance of ablation materials having potential application as radio frequency windows. These tests were conducted for the improvement of omnidirectional antenna operating characteristics during atmospheric reentry. Since a full scale model of the Apollo command service module was available for antenna tests, this mockup was used as a basic for the tests. Test models were subjected to heating conditions simulating the nominal lunar return trajectory (AS-501) and the design trajectories, high heat load and high heating rate. RF measurements were made before and after the arc jet tests to measure attenuation effects due to the thermal degradation of the materials under consideration. The test program demonstrated that additional development is required in materials technology to achieve an ablative system with both good RF transmission characteristics and thermal-structural integrity. Author

N72-22221*# Pratt and Whitney Aircraft, West Palm Beach, Fla.
INHERENT REDUNDANCY ELECTRIC HEATER Patent Application
Bruce H. Kernodle, inventor (to NASA) Filed 30 Mar. 1972 10 p Sponsored by NASA
(NASA-Case-MFS-21462-1; US-Patent-Appl-SN-239576) Avail: NTIS CSCL 09E

A cross-wound electrical heater, comprising two resistance coils wound together with opposite pitches and electrically connected at their crossing points, is described. Each element is supplied by a separate power supply of the same magnitude, and each power supply is isolated from reverse currents by a diode. Failure of one of the windings results in only a moderate change in output power. NASA

N72-22222# California Univ., Livermore. Lawrence Radiation Lab.
HIGH RATE DIRECT COUPLED PREAMPLIFIER FOR HIGH ENERGY Ge DETECTOR SYSTEMS
James H. McQuaid Sep. 1971 58 p refs Presented at the Nucl. Sci. Symp., San Francisco, 3-5 Nov. 1971 Sponsored by AEC
(UCRL-73239; Conf-711111-17) Avail: NTIS

The fast counting of high energy gamma events with excellent resolution is made possible by the design of a recycling preamplifier and a direct-coupled spectrometer system. Measurements were performed with a 40 cc Ge(Li) coaxial detector. Data were observed with and without pile-up rejection for count rates up to 150,000 counts/s. The exceptional performance of this direct-coupled system is attributed to the preamplifier which requires no pole-zero compensation. After single differentiation the pulses return precisely to the baseline.
Author (NSA)

N72-22223# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Teoreticheskoi i Eksperimentalnoi Fiziki.
ELECTROSTATIC CONDENSERS IN VACUUM, REVIEW
V. A. Ergakov, I. I. Kryuchkov, and Yu. V. Trebukhovskii 1970 37 p refs In RUSSIAN; ENGLISH summary
(ITEF-803) Avail: AEC Depository Libraries

Aspects of choosing the kind and pressure of residual gas and of electric materials to obtain the maximum electric field in the 2 to 20 cm gap of an electrostatic condenser with a pair of parallel plane electrodes in the vacuum are described. Some questions of choosing electrode materials and methods for obtaining the uniform electric field along insulators are discussed. The construction of the bushings (250 kV to 1 mV) is given. There are 26 references. Author (NSA)

N72-22224# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
EXTRACTION OF A PERIODIC SIGNAL FROM NOISE [ESTRAZIONE DI UN SEGNOLE PERIODICO DAL PUMORE]

R. Cervellati, A. Giomi, M. Zagara, and F. Zippel 4 Jan. 1971 33 p refs In ITALIAN
(RT/EL-(70)8) Avail: AEC Depository Libraries

A simple sampling circuit has been realized which increases the signal to noise ratio by a factor of 7. It operates on a waveform which could be synchronized with the circuit itself at a repetition time of 100 microseconds. Some topics are discussed concerning the sampling technique and the methods suitable for a quantitative evaluation of the circuit behavior. Author (NSA)

N72-22225# European Organization for Nuclear Research, Geneva (Switzerland).
DOUBLE THRESHOLD GENERATOR TYPE NP 2241 [DOUBLE GENERATEUR DE PORTES TYPE NP 2241]
G. Delavallade 1 Dec. 1971 8 p In FRENCH
(CERN-71-27) Avail: AEC Depository Libraries

A generator was constructed to give a very time-precise threshold pulse. The circuits of the generator are given. NSA

N72-22226# Illinois Univ., Urbana. Dept. of Computer Science.
ALPHECHON: EVALUATION OF A DEVELOPMENTAL VIDEO STORAGE TUBE
Dennis A. Kodimer Sep. 1971 45 p refs
(Contract AT(11-1)-1469)
(COO-1469-197) Avail: NTIS

The Alphechon is a developmental storage tube designed for nondestructive, continuous readout or information presented as a message on a standard TV frame, with the purpose of providing real time, moderate resolution video storage. A video storage system was constructed about the Alphechom its performance was evaluated for possible use in an on-line Fourier transform system. Circuit schematics for a TV frame storage system were provided and these circuits were constructed and found to be lacking in stability, ease of adjustment, and video resolution. A more complex system was constructed, which minimized the number of power supplies required by the system and feedback in the circuits driving various elements of the Alphechon. Drift of the adjustments was minimized, more parameters affecting the operation of the Alphechon were made adjustable, and the bandpass of the video processing circuits was increased. Additionally, the system was made compact, and considerably more rugged and portable than the first system.
Author

N72-22227# Signals Research and Development Establishment, Christchurch (England).
DIGITAL SIMULATION OF NON-LINEAR COMPONENTS OF COMMUNICATION SYSTEMS
P. D. Morgan Sep. 1971 12 p refs
(SRDE-71031; BR-27129) Avail: NTIS

The use of Fourier techniques in computer-aided design of communications equipment has been extended by the development of a method of simulation non-linear components, such as amplifiers. Author (ESRO)

N72-22228# IBM Watson Research Center, Yorktown Heights, N.Y.
INVESTIGATION OF HIGHLY-DOPED SCHOTTKY-BARRIER FIELD-EFFECT TRANSISTORS: GALLIUM ARSENIDE
Theodor O. Mohr 16 Jun. 1971 42 p refs
(Contract F19628-70-C-0094; AF Proj. 4608)
(AD-735299; AFCRL-71-0496; SR-3) Avail: NTIS CSCL 09/1

GaAs Schottky-barrier field-effect transistors have shown excellent properties as high-frequency devices and in respect to noise behavior. Improvements in technology and the physical layout have resulted in device qualities far beyond the limits of available measuring equipment. More precise techniques are therefore required for characterization. One viable approach with the existing equipment is error correction in scattering parameter measurements. This subject is discussed in the first section of the report. The second section deals with noise measurements on newly designed transistors with one gate land only. The measured results are discussed in detail and a model is given which includes noise contributions due to intervalley scattering and carrier drift velocity saturation. Author (GRA)

N72-22229# Harry Diamond Labs., Washington, D.C.
A THICK-FILM MICROSTRIP SINGLE-SIDEBAND PIN DIODE MODULATOR FOR X-BAND
William L. Muckelroy Dec. 1971 24 p ref
(DA Proj. 1B2-62301-A-301)
(AD-735317; HDL-TM-71-17) Avail: NTIS CSCL 09/5

A microstrip single-sideband modulator that operates at 9 GHz was developed for simulating target Doppler fuzes. The circuit consists of two pin diodes terminating a single input-output line. These two diodes are located with a difference in electrical spacing from the common input line of one-eighth wavelength at the carrier frequency. The diodes are mounted onto gold tabs 20 by 65 mils with two 20-mil-long wire leads connected to the diode junction. Using a thick-film subtractive technique, the microstrip circuit is produced on alumina (Al_2O_3). Both sides of a standard 1-sq. in. alumina substrate are metallized, using thick-film technology; the microstrips are formed by photoetching one side. The diodes are epoxy bonded, and their wire leads are thermocompression bonded. Author (GRA)

N72-22230# Naval Research Lab., Washington, D.C. Search Radar Branch
IMPEDANCE MATCHING OF A DIELECTRIC-LOADED WAVEGUIDE RADIATOR IN A PHASED ARRAY Final Report
James K. Hsiao 29 Dec. 1971 23 p refs
(AD-736181; NRL-7344) Avail: NTIS CSCL 09/5

In considering the general problem of impedance matching reduced-size, dielectric-loaded waveguide elements in a phased array, various commonly used matching devices were reviewed. A design method based on pattern search is introduced here for matching a high-VSWR load. As an example, a two-section transformer has been designed for matching waveguide radiators in a phased array. The waveguide load before matching has a VSWR of about 7 to 8 across a 10-percent band (plus or minus 5 percent of the center frequency). After matching, the VSWR is approximately 1.25 and quite constant over the band, having maximum values of 1.77 and 1.52 respectively at the lower and upper edges of the band. Author (GRA)

N72-22231# ITT Electron Tube Div., Fort Wayne, Ind.
PATTERN THRESHOLD RECOGNITION DEVICE Quarterly Report, 1 May - 31 Jul. 1971
S. Nevin and L. G. Wolfgang Dec. 1971 17 p
(Contract DAAB07-71-C-0226)
(AD-736522; ECOM-0226-1; QR-1) Avail: NTIS CSCL 09/1

The purpose of this contract is to further develop the pattern threshold recognition device by studying its electron optics and target. To make the device more practical, mechanical and processing improvements to extend the tube's lifetime are desired. A demountable electron-optical test bench has been designed and is being fabricated. A processing schedule with rigorous outgassing of the tube's electrodes is being evaluated in test tubes. Author (GRA)

N72-22232# Army Electronics Command, Fort Monmouth, N.J.
EXPERIMENTAL GRIDDED MAGNETRON-INJECTION-GUN PROTOTYPE
Paul Fischer Jan. 1972 25 p refs
(DA Proj. 1S6-62705-A-055)
(AD-736365; ECOM-3525) Avail: NTIS CSCL 09/1

An experimental magnetron injection gun was designed and built with the specific intent of enhancing and controlling beam noise. The gun is axially symmetric and produces a hollow, high-perveance, electron beam. Both cathode and anode are truncated cones; the anode encloses the cathode and is concentric with it. Between cathode and anode are four cylindrical grid wires parallel to the gun axis of symmetry and

equidistant from it (and therefore also from the cathode); distance between adjacent grid wires is constant. After construction, the gun was mounted in a vacuum-tube configuration for experimental evaluation. Noise measurements were made by means of a high-sensitivity spectrum analyzer. Author (GRA)

N72-22233# Aerospace Corp., El Segundo, Calif.
A HIGH VOLTAGE CURRENT REGULATOR FOR LASER GAS DISCHARGE TUBES
Michael J. Posakony 15 Nov. 1971 24 p refs
(Contract F04701-71-C-0172)
(AD-736024; TR-0172(9230-20)-5; SAMSO-TR-71-319) Avail: NTIS CSCL 09/5

The design and applications of high-voltage-range series current regulators are discussed. A sample design maintains the current to within 1% of a selected value between 100 microampere and 50 mA over a 15-KV voltage range. The regulator is ideal for regulating or pulsing laser gas discharges. The circuit can also be used as a high-output voltage amplifier. In this service it can deliver 10 kHz with 1.4% total harmonic distortion.
Author (GRA)

N72-22234# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DEVELOPMENT OF LITHIUM FERRITES FOR ARRAY RADAR PHASERS Final Report, 1 Jul. 1969 - 31 Aug. 1971
Paul D. Baba and Gil M. Argentina 30 Aug. 1971 56 p refs
Prepared in cooperation with Ampex Corp., Redwood City, Calif.
(Contract F19628-70-C-0230; DA Proj. 7X2-63304-D-215)
(AD-736038; ESD-TR-71-267) Avail: NTIS CSCL 09/5

The report discusses the development of microwave S- and C-band lithium ferrites with substantially improved properties, comparable to those of the more expensive ferrimagnetic garnets currently in use. Although the development of these materials has been directed at applications for latching microwave devices, they are also useful for other microwave devices. The requirements for ferrite materials in latching phasers are reviewed, the compositional factors which result in useful properties are discussed, and performance in circulators and latching phasers is reported. Author (GRA)

N72-22623# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.
A LIMITED STUDY OF THE TRADE-OFF BETWEEN LUMINANCE AND COLOR CODING IN ELECTRONIC AIRCRAFT DISPLAYS
Ralf Beyer *In* AGARD Guidance and Control Displays Feb. 1972 9 p refs (See N72-22621 13-21)
Avail: NTIS

N72-22628# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
A SYMBOL GENERATOR FOR THE ANTHROPOTECHNICAL EVALUATION OF INTEGRATED DISPLAYS
K.-F. Kraiss *In* AGARD Guidance and Control Displays Feb. 1972 7 p refs (See N72-22621 13-21)
Avail: NTIS

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N72-22235* Radio Corp. of America, Princeton, N.J.
TARGET ACQUISITION ANTENNA Patent
Joseph P. Grabowski and Walter E. Powell, Jr., inventors (to NASA) Issued 23 Nov. 1971 9 p Filed 27 Feb. 1969 Sponsored by NASA
(NASA-Case-GSC-10064-1; US-Patent-3,623,094;
US-Patent-Appl-SN-802812; US-Patent-Class-343-7.4;
US-Patent-Class-343-16M; US-Patent-Class-343-779;
US-Patent-Class-343-786) Avail: US Patent Office CSCL 09C

A target tracking and acquisition system including a Cassegrain reflector system driven by three horn elements is described. One horn excites a main lobe coincident with the reflector system boresight axis while the other horns excite main lobes at off axis angles above and below the boresight axis. Relatively high amplitude crossovers exist between the three main lobes. The feed producing the main lobe coincident with the boresight axis lies at a focal point of the reflector system, while the feeds which excite the other two main lobes are removed from the boresight, elevation and azimuth axes of the reflector system. The feed elements are driven through a frequency multiplexer, having a plurality of cascaded channels. Each of the channels, except one, includes a pair of hydrids, between which are connected a pair of high pass filters.
Official Gazette of the U.S. Patent Office

N72-22236* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FAST RESPONSE LOW POWER DRAIN LOGIC CIRCUITS Patent
Ciro A. Cancro, inventor (to NASA) Issued 16 Nov. 1971 7 p Filed 31 Dec. 1969 Supersedes N70-22186 (08 - 09, p 1617)
(NASA-Case-GSC-10878-1; US-Patent-3,621,277;
US-Patent-Appl-SN-889423; US-Patent-Class-307-206;
US-Patent-Class-307-215; US-Patent-Class-307-322;
US-Patent-Class-307-323) Avail: US Patent Office CSCL 09C

Switching circuits, useful as basic logic circuits, that comprise tunnel diodes in combination with transistors are described. The use of tunnel diodes, constant current switching, and series feedback between transistors results in switching circuits with very fast response times and low power drains.
Official Gazette of the U.S. Patent Office

N72-22237*# Scientific Translation Service, Santa Barbara, Calif.
RELIABILITY OF CONVERTER NETWORKS OF THERMIONIC POWER SUPPLY EQUIPMENTS
S. Dagbjartsson Washington NASA Apr. 1972 65 p refs Transl. into ENGLISH from "Zuverlaessgkeit der Konverternetzwerke von Thermionischen Energieversorgungsanlagen", Stuttgart Univ., 1970 72 p
(Contract NASw-2035)
(NASA-TT-F-14237) Avail: NTIS CSCL 09C

Taking into account the current-voltage characteristics of thermionic converters, the current and voltage values characteristic of the individual branches of a network are examined, particular attention being given to the failure of individual converters. The failure is considered to be a statistical event that occurs with equal probability in all converters during the operation of a converter network. This formalism makes it possible to calculate the network reliability as a function of the possible excess output at the beginning of the operation period. It was found that the probability of failure of any converter is 5%, and that the emitter temperature of some converters, which is initially about 1860 K, exceeds with a probability of about 10% the temperature of 2000 K. Author

N72-22238*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EVENT SEQUENCE DETECTOR Patent Application
Michael F. Hanna, inventor (to NASA) Filed 4 Feb. 1972 26 p
(Contract NAS7-100)
(NASA-Case-NPO-11703-1; US-Patent-Appl-SN-223560) Avail: NTIS CSCL 09C

An event sequence detector is described with several input units, each associated with a row of bistable elements arranged in an array of rows and columns. A shift register is included

which is responsive to clock pulses from any of the units to sequentially provide activity signals on its output lines each of which is connected to the bistable elements in a corresponding column. When an event-indicating signal is received by an input unit, it provides a clock pulse to the shift register to provide the enabling signal on one of its output lines. The input unit also activates all its bistable elements so that the particular element in the column supplied with the signal from the register is driven to an event-indicating state. NASA

N72-22239*# National Aeronautics and Space Administration, Washington, D.C.
ELECTRONIC TEST AND CALIBRATION CIRCUITS, A COMPILATION
1972 22 p
(NASA-SP-5951(01)) Avail: NTIS HC $1.00/MF $0.95 CSCL 09C

A wide variety of simple test calibration circuits are compiled for the engineer and laboratory technician. The majority of circuits were found inexpensive to assemble. Testing electronic devices and components, instrument and system test, calibration and reference circuits, and simple test procedures are presented. Author

N72-22240# Sandia Labs., Albuquerque, N.Mex.
LEAD FRAME BONDING: AN INTERCONNECTIONS DEVELOPMENT AREA FOR THE FIRST GENERATION HYBRID MICROCIRCUIT TECHNOLOGY DEVELOPMENT PROGRAM
Donald R. Johnson Dec. 1971 35 p refs
(SC-DR-710539) Avail: NTIS

The development of a thermocompression bonding technique is described, as applied to the interconnection of external leads to a metallized ceramic substrate for the first-generation hybrid microcircuit. The problem was in achieving consistent, high quality bonds through the simultaneous attachment of multiple leads to the substrate metallization. Procedural details involving the choice and processing of copper alloy lead frames, bonding head materials and configuration, and the technique parameters of time, temperature, and force are defined. The analysis of the parameter response of a designed experiment is discussed. It was concluded that CDA copper alloy 194 was most suitable as a lead frame material. Additionally, it was concluded that optimum bond strength was dependent not only on the lead frame material and the combination of parameters utilized, but also on the quality of the substrate metallization and the ceramic itself. Recommendations are presented for further investigation of such variables as nondestructive test methods, bond interface temperatures, plating and metallization in conjunction with a metallurgical analysis of the diffusion, and deformation aspects of the bonds. Author

N72-22241# Helsinki Univ. (Finland). Radio Lab.
A NEW SYNTHESIS METHOD FOR BRANCH-GUIDE DIRECTIONAL COUPLERS
Martti Valtonen 1971 20 p refs
(S-47-1971) Avail: NTIS

A narrowband, equivalent circuit for a two part network consisting of cascaded unit length, lossless transmission lines and lumped or distributed lossless shunt elements between them is obtained by replacing the shunt elements by imaginary conductances. This type of network model may be used in the design of both symmetrical and asymmetrical branch guide directional couplers. An optimum termination impedance ratio giving the minimum VSWR level for fixed directivity and coupling level is given. Author (ESRO)

N72-22242# Naval Research Lab., Washington, D.C. Mathematics and Information Sciences Div.
CONTROLLABILITY, REALIZATION, AND STABILITY OF DISCRETE-TIME SYSTEM Final Report
Leonard Weiss 30 Dec. 1971 29 p refs
(AD-736184; NRL-7357; Rept-71-8) Avail: NTIS CSCL 12/1

The following problems are discussed and solved in the paper: Finding computable, necessary and sufficient conditions for complete reachability and complete observability of a linear, time-varying, discrete-time system; Finding sufficient conditions for complete reachability of nonlinear discrete-time systems; Relating reachability to the concept of discrete Pfaffian systems; Obtaining a minimal-dimension difference equation (with possibly variable coefficients) from a given input/output function of a system; Finding necessary and sufficient conditions for Lyapunov stability and finite-time stability of nonlinear difference equations; Giving an algorithm for determining whether a linear difference equation is stable in the finite-time sense. Author (GRA)

N72-22243# Stanford Univ., Calif.
LARGE (g,d) SORTING NETWORKS
David C. VanVoorhis Aug. 1971 62 p refs
(Contract N00014-67-A-0112-0044; Grant NSF GJ-1180)
(AD-736610; SU-SEL-71-052; STAN-CS-71-239; TR-18) Avail: NTIS CSCL 09/2

With only a few exceptions the minimum-comparator N-sorter networks employ the generalized divide-sort-merge strategy. That is, the N inputs are divided among g = or - 2 smaller sorting networks -- of size N1,N2,...,Ng, where N - summation from k - 1 to g of (N sub k) -- that comprise the initial portion of the N-sorter network. The remainder of the N-sorter is a comparator network that merges the outputs of the N1-,N2-,..., and Ng-sorter networks into a single sorted sequence. The most economical merge networks yet designed, known as the (g,d) merge networks, consist of d smaller merge networks -- where d is a common divisor of N1,N2,...Ng -- followed by a special comparator network labeled a (g,d) f-network. The paper describes special constructions for ((2 sup r), (2 sup r)) f-networks. Author (GRA)

N72-22244# California Univ., Los Angeles. Dept. of Mathematics.
A LOWER BOUND FOR THE MINIMUM RISETIME OF BANDLIMITED SYSTEMS
Victor Barcilon and Gabor T. Temes 1972 13 p refs
(Contract N00014-69-A-0200-4022; Grants NSF GK-23891; NR Proj. 044-144)
(AD-736629) Avail: NTIS CSCL 09/5

It is shown that the risetime T, bandwidth omega sub 0 and overshoot epsilon of the step-response of a bandlimited system are subject to the inequality omega(sub 0)T= -ln square root of (2 epsilon). Author (GRA)

N72-22213*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MICROWAVE POWER TRANSMISSION CONSIDERATIONS FOR EARTH ORBITAL SPACE MISSIONS
W. J. Robinson, Jr. *In its* Res. Achievements Rev., Vol. 4, Report no. 4 Feb. 1972 p 63-66 refs (See N72-22207 13-09)
Avail: NTIS CSCL 09C

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N72-22245* Northrop Corp., Hawthorne, Calif.
SHOCK TUBE BYPASS PISTON TUNNEL Patent
Stellan P. Knoos, inventor (to NASA) Issued 12 Oct. 1971 9 p

Filed 13 Dec. 1967 Sponsored by NASA
(NASA-Case-NPO-12109; US-Patent-3,612,391;
US-Patent-Appl-SN-690172; US-Patent-Class-230-54;
US-Patent-Class-230-221) Avail: US Patent Office CSCL 14B

A gas, preferably preheated, is released in a tube having a free piston, a piston bypass structure, and a vacuum chamber. In operation, a portion of this gas bypasses the piston into the vacuum chamber. The gas which is not bypassed brings the piston into motion to automatically close the bypass and then compress the bypassed gas and build up a very high temperature and pressure in the bypassed gas. A second, perforated, piston may be initially placed downstream of the first piston to increase system efficiency and act as a safety device.

Official Gazette of the U.S. Patent Office

N72-22246* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
VARIABLE GEOMETRY WIND TUNNELS Patent
Harry H. Heyson, inventor (to NASA) Issued 16 Nov. 1971 7 p Filed 20 Oct. 1969 Supersedes N70-35678 (08 - 19, p 3523)
(NASA-Case-XLA-07430; US-Patent-3,620,076;
US-Patent-Appl-SN-867841; US-Patent-Class-73-147) Avail: US Patent Office CSCL 14B

A variable geometry wind tunnel is described for testing aircraft models in subsonic tests representing the low speed phases of flight. The system provides for variation of the test section of the tunnel during a test and reduces the corrections needed in data obtained in subsonic wind tunnel tests. The system is computerized to attain optimum test conditions.

Official Gazette of the U.S. Patent Office

N72-22247* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SELF-OBTURATING, GAS OPERATED LAUNCHER Patent
Otto K. Heiney, inventor (to NASA) Issued 16 Nov. 1971 6 p Filed 17 Sep. 1969 Supersedes N70-35519 (08 - 19 p 3522) Sponsored by NASA
(NASA-Case-NPO-11013; US-Patent-3,619,924;
US-Patent-Appl-SN-858695; US-Patent-Class-42-1F) Avail: US Patent Office CSCL 22D

A gas operated launcher is described which is particularly suited for use in launching projectiles in a decontaminated medium. The device is characterized by the utilization of an elongated barrel including a rigid, barrel-sealing breach block, a muzzle block having a bore through which a projectile is ejected, and a malleable slug placed within the barrel adjacent to the breach block. An expandable firing chamber is located within the barrel and adapted to be driven toward the muzzle block for launching a projectile as a pyrotechnic material is ignited within the chamber. The launcher contains a number of openings formed within the muzzle block for relieving back-pressure, and an annular anvil circumscribing the bore of the muzzle block for receiving the malleable slug in impacted engagement to achieve hermetic sealing of the bore and retain within the barrel the residue of the ignited pyrotechnic material.

Official Gazette of the U.S. Patent Office

N72-22248# Federal Aviation Administration, Washington, D.C.
MEASUREMENT OF RUNWAY FRICTION: AIRPLANE/DBV/MU-METER CORRELATION TESTS Progress Report
1 Jan. 1972 21 p refs
(FS-160-65-68-4; Rept-72-00187) Avail: NTIS

The results are summarized from tests of a Boeing 727-100 Aircraft, a diagonally braked vehicle, and a Mu-Meter on six runway surfaces under dry and artificially wet conditions. Author

N72-22249# Weapons Research Establishment, Salisbury (Australia).
AUSTRALIAN EAST-WEST BASELINE INTERFEROMETER OBSERVATIONS AT 2.3 GHz
J. S. Gubbay, A. J. Legg, and D. S. Robertson Sep. 1971 10 p refs
(WRE-TN-464(WR/D)) Avail: NTIS

Interferometer experiments using stations of the Deep Space Network are discussed. Observational results using the Australian stations, DSS41 at Island Lagoon and DSS42 at Tidbinbilla, are present in tabular form. Author

N72-22250*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPACE SIMULATION
Washington 1972 1093 p refs Proc. of the Symp. held at New York, 1-3 May 1972; sponsored by Inst. of Environ. Sci., AIAA, Am. Soc. for Testing and Mater., and NASA
(NASA-SP-298) Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

The papers presented at the Sixth Space Simulation Conference are reported. For individual titles, see N72-22251 through N72-22312.

N72-22251*# Southwest Research Inst., San Antonio, Tex.
OPERATION OF SOUTHWEST RESEARCH INSTITUTES HIGH INTENSITY ARC IMAGE FACILITY
E. Jack Baker, Jr. *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 1-10 (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

The arc-image furnace which was primarily designed as a high-intensity pure thermal radiation test facility is described. Its operation, characteristics, and potentialities are discussed.

Author

N72-22252*# Boeing Co., Seattle, Wash.
DEVELOPMENT OF A HIGH IRRADIANCE SOURCE
A. R. Lunde *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 19-38 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

Irradiance levels up to 17.27 sq in/sec. with a nonuniformity ratio of 1.07 have been developed to simulate high heat flux loads on the surface of difference materials. This has been achieved by an arc image furnace utilizing a 50 kw xenon short arc lamp mounted within an elliptical collector. Author

N72-22253*# McDonnell-Douglas Co., St. Louis, Mo.
EXPERIMENTS WITH THE SKYLAB FIRE DETECTORS IN ZERO GRAVITY
R. M. F. Linford *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 41-55 refs (See N72-22250 13-11)
(Contract NAS9-6555)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

The Skylab fire detector was evaluated in a zero gravity environment. To conduct the test, small samples of spacecraft materials were ignited in a 5 psi oxygen-rich atmosphere inside a combustion chamber. The chamber free-floated in the cabin of a C-135 aircraft, as the aircraft executed a Keplerian parabola. Up to 10 seconds of zero-gravity combustion were achieved. The Skylab fire-detector tubes viewed the flames from a simulated distance of 3m, and color movies were taken to record the nature of the fire. The experiments established the unique form of zero-gravity fires for a wide range of materials. From the tube-output data, the alarm threshold and detector time constant were verified for the Skylab Fire Detection System. Author

N72-22254*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
TRAINING AND CERTIFICATION PROGRAM OF THE OPERATING STAFF FOR A 90-DAY TEST OF A REGENERATIVE LIFE SUPPORT SYSTEM
In NASA. Goddard Space Flight Center Space Simulation 1972 p 57-68 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

Prior to beginning a 90-day test of a regenerative life support system, a need was identified for a training and certification program to qualify an operating staff for conducting

the test. The staff was responsible for operating and maintaining the test facility, monitoring and ensuring crew safety, and implementing procedures to ensure effective mission performance with good data collection and analysis. The training program was designed to ensure that each operating staff member was capable of performing his assigned function and was sufficiently cross-trained to serve at certain other positions on a contingency basis. Complicating the training program were budget and schedule limitations, and the high level of sophistication of test systems. Author

N72-22255*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
FACILITIES AND SUPPORT SYSTEMS FOR A 90-DAY TEST OF A REGENERATIVE LIFE SUPPORT SYSTEM
Robert L. Malin *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 69-78 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

A 90-day test is reported of a regenerative life support system which was completed in a space station simulator. The long duration of the test and the fact that it was manned, imposed rigid reliability and safety requirements on the facility. Where adequate reliability could not be built into essential facility systems, either backup systems or components were provided. Awareness was intensified by: (1) placing signs on every piece of equipment that could affect the test, (2) painting switches on all breaker panels a bright contrasting color, (3) restricting access to the test control area, and (4) informing personnel in the facility (other than test personnel) of test activities. It is concluded that the basic facility is satisfactory for conducting long-duration manned tests, and it is recommended that all monitor and alarm functions be integrated into a single operation. F.O.S.

N72-22256*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
SAFETY ASPECTS OF A 90-DAY MANNED TEST OF A REGENERATIVE LIFE SUPPORT SYSTEM
J. P. Valinsky *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 79-88 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298

The safety aspects of the manned space station simulator test are identified. The methods used to satisfy safety requirements are presented, and the safety systems and procedures evaluated. F.O.S.

N72-22257*# General Electric Co., Philadelphia, Pa. Space Div.
GE UNDERWATER TEST FACILITY STUDIES IN ZERO G SIMULATION
Ruth H. Fry *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 89-102 (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

The underwater test facility (UTF) is described as an indoor controlled environment test facility designed specifically for zero G simulation, hydrospace manned and unmanned equipment development, and personnel training for both space and underwater exploration. Programs conducted in the UTF include: human engineering criteria for maintenance and repairs of space stations, astronaut performance, helmet distortion, underwater telemetry, and blood transfusion. F.O.S.

N72-22258*# North American Rockwell Corp., Downey, Calif.
VACUUM STABILITY TESTING OF APOLLO 15 SCIENTIFIC INSTRUMENT MODULE (SIM) NON-METALLIC MATERIALS AND REVERSION OF SILICONE RUBBER IN A MOTOR SWITCH
H. M. Clancy *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 107-149 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

Vacuum stability screening tests were performed on the Apollo 15 Scientific Instrument Module (SIM) bay nonmetallic materials in accordance with the NASA document SP-R-0022. The testing was necessary to support the evaluation to determine the effect material outgassing contamination would have on the SIM bay optical lenses and sensing devices. The Apollo 15 SIM experiments were highly successful, therefore, it is assumed that contamination due to the outgassing of nonmetallic materials did not affect equipment operation. A related problem, the reversion of a silicone rubber grommet which affected an electrical motor switch operation is also reported. Author

N72-22259*# Brown and Root, Inc., Houston, Tex.
SOME NEW TECHNIQUES IN PASSIVE CONTAMINANT ANALYSIS OF SPACE ENVIRONMENT SIMULATION CHAMBERS
C. M. Wolff *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 151-170 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

A passive contamination analysis technique in surface sampling for space simulation was developed and evaluated. The KBr pelletizing technique was extended to invlude heavy oils for infrared analysis. Transmittance and specular reflectance measurements at 2000 A wavelength were found very sensitive to contamination. Author

N72-22260*# Aerospace Corp., El Segundo, Calif.
RADIATION EFFECTS ON CONTAMINANTS FROM THE OUTGASSING OF SILASTIC 140 RTV c18
Peter F. Jones *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 173-177 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 11D

Exposure of the volatile condensable material (VCM) from Silastic 140 RTV adhesive sealant to 147. 0-nm radiation, simulating the space radiation environment in synchronous earth orbits, induces absorption of visible light by the VCM. This results in an increase in the absorptance of coated optical elements, such as solar cell cover glasses and second-surface mirrors for thermal control. A contaminant thickness of 0.1 micron or more could result in a change in solar absorptance of the second-surface mirrors from 0.06 to approximately 0.16 in a period of about 1.5 years in space. Calculations indicated that the VCM thickness would have to be less than approximately 0.005 micron to keep the change in solar absorptance < 0.01 for a 3-year mission. Author

N72-22261*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EXPERIMENTAL DETERMINATION OF STICKING COEFFICIENTS c08
E. E. Klingman *In its* Space Simulation 1972 p 181-192 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 09B

A Monte Carlo computer program is used in conjunction with experimental data to determine the sticking coefficient for RTV-501 on silver. Author

N72-22262*# Brown and Root, Inc., Houston, Tex.
THE DESIGN AND APPLICATION OF AN INFRARED SIMULATOR FOR THERMAL VACUUM TESTING
Douglas J. Skinner, Steven P. Wallin, and Calvin M. Wolff *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 197-216 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

An infrared simulator was developed and installed in SIM Chamber A in support of the Apollo lunar-exploration mission thermal vacuum testing. The simulator was designed to provide thermal simulation of the radiation emitted and reflected by the lunar surface incident on the Apollo service module in a 60-mile-altitude lunar orbit. The infrared simulator comprises 18 individually controlled zones that provide the irradiance profiles over a 180 deg arc around the spacecraft, simulating the flux levels of equatorial, polar, and 45 deg lunar orbits. Author

N72-22263*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
CONTROL OF AN ARTIFICIAL INFRARED ENVIRONMENT TO SIMULATE COMPLEX, TIME VARYING ORBITAL CONDITIONS
Ray L. Dewey *In its* Space Simulation 1972 p 217-230 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

A computer-controlled infrared simulation system has recently been developed for thermal vacuum ground testing of spacecraft in the Space Environment Simulation Laboratory of the NASA Manned Spacecraft Center. The system can simultaneously follow as many as 30 separate time-varying intensity profiles for irradiation of different areas of a test spacecraft, producing an environment that more closely resembles the changing conditions experienced by an orbiting spacecraft. A description of the hardware is included, but emphasis is placed upon computer techniques that have been developed to maximize the capabilities of the control system within the constraints imposed by a limited computer capability. Among the topics discussed are open-loop control, closed-loop control, manual alteration of profiles, compensation for slow response of the radiation source, and compensation for interacting control zones. Examples of typical results obtained using the control system are also presented.
Author

N72-22264*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
PREDICTING AND ANALYZING THE THERMAL FLUX INCIDENT ON TEST ARTICLES IN A SIMULATED SPACE ENVIRONMENT
Steven P. Wallin, D. W. Halstead, J. H. Stvart, and C. L. Smithson, Jr. *In its* Space Simulation 1972 p 231-249 (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

The increase in importance and sophistication of thermal-vacuum testing has accentuated the problem of defining the environment to which the test article was subjected. An adequate definition of the test environment is essential to the verification of test-article thermal models. The technique used for defining the test environment at the NASA Manned Spacecraft Center Space Environment Simulation Laboratory and its application during a recent major thermal-vacuum testing program is discussed.
Author

N72-22265*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
AN AUTOMATED SYSTEM FOR THE ALIGNMENT OF LARGE AREA MODULAR SOLAR SIMULATORS
James P. Vincent, Leo F. Polak (Electro-Optical Systems, Inc.), and P. S. Fisher (Electro-Optical Systems, Inc.) *In its* Space Simulation 1972 p 251-268 (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

A real-time optical alignment and diagnostic system is being assembled for installation at the Space Environment Simulation Laboratory. This system will be used to measure and analyze the performance of optical components, assemblies, and full modules. This information, in turn, is used to align assemblies and modules. The system capability includes such functions as the generation and updating of a catalog, which serves as permanent record, in addition to providing the capability to predict in-chamber performance of optics combinations before they are mounted in the chamber.
Author

N72-22266*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A COMPARISON OF SIMULATED REDUCED GRAVITY FLIGHT WITH ACTUAL ORBITAL FLIGHT CONDITIONS
Donn Eisele and Scott MacLeod (Grumman Aerospace Corp.) *In its* Space Simulation 1972 p 269-279 (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

Five basic techniques used to simulate reduced gravity are compared. Some representative Apollo 7 experiences are cited for comparison.
Author

N72-22267*# McDonnell Aircraft Corp., St. Louis, Mo.
FULL-SCALE SKYLAB APOLLO TELESCOPE MOUNT DEPLOYMENT TESTS
G. F. Fricker *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 281-290 (See N72-22250 13-11) (Contract NAS9-6555)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

During the initial stages of the NASA Skylab orbit, the Apollo telescope mount (ATM) is deployed by the deployment assembly (DA) which clears the multiple docking adapter axial docking port. This is an essential prerequisite to docking the command service module with the orbital workshop and subsequent occupancy of the workshop by the Apollo three-man crew. The objectives of the full-scale NASA Skylab ATM deployment test program were (1) to evaluate the design concept of the DA and deployment mechanisms while functioning in a zero-g environment with simulated ATM mass properties and (2) to evaluate the effects of handling, transporting, and deployment with respect to the structural geometry and stability of the DA.
Author

N72-22268*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
MANNED THERMAL-VACUUM TEST OPERATIONS: ITS DEVELOPMENT FROM EXPERIMENTAL TO ROUTINE
Paul R. Gauthier (Boeing Co.), Herbert G. Sherwin (Brown and Root, Inc.), and Marion M. Lusk *In its* Space Simulation 1972 p 291-312 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

Manned operations were a significant part of Gemini and Apollo thermal-vacuum test programs. The development of test techniques and equipment at the Space Environment Simulation Laboratory is discussed relative to these programs.
Author

N72-22269*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ZERO g MANUAL CARGO HANDLING
Amos A. Spady, Jr. and Gary P. Beasley *In its* Space Simulation 1972 p 313-330 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

A series of studies were conducted utilizing a water-immersion simulator facility to better define the cargo that can realistically be handled by man. The initial phase of the program was a parametric study to define man's intravehicular (IV) cargo transfer capabilities, and its results are reported. Additional phases of the study, deal with: (1) man's ability to perform extravehicular (EV) cargo transfer, (2) the ability to transfer cargo through a 1.5 m (5-foot) diameter tunnel (IV), and (3) the utilization of electroadhesive/electromagnetic mobility aids for both IV and EV self-locomotion and cargo transfer.
Author

N72-22270*# Atlantic Research Corp., Alexandria, Va.
HABITABLE ATMOSPHERES WHICH DO NOT SUPPORT COMBUSTION
Edward T. McHale *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 331-335 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

It appears that habitable atmospheres can be developed in which humans will be able to live and function normally for extended periods of time with no physiological harm, but which at the same time will not support combustion of ordinary materials such as paper, cloth, gasoline, etc. These atmospheres might contain 3 psia partial pressure of oxygen as does ordinary air; or oxygen-enriched atmospheres as used in aerospace environments could be employed. Certain inert polyatomic gases, namely, CF_4, C_2F_6 or C_3F_8, are incorporated into the atmosphere. These impart the property of completely suppressing flammability, while retaining the life support capability. Some of

the other compounds, notably CF3Br (Halon 1301), are effective fire suppressants but are not physiologically inert. Author

N72-22271*# Radio Corp. of America, Princeton, N.J. Astro-Electronics Div.
LOW-g SIMULATION TESTING OF PROPELLANT SYSTEMS USING NEUTRAL BUOYANCY
D. L. Balzer and R. J. Lake, Jr. *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 337-348 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

A two liquid, neutral buoyancy technique is being used to simulate propellant behavior in a weightless environment. By equalizing the density of two immiscible liquids within a container (propellant tank), the effect of gravity at the liquid interface is balanced. Therefore the surface-tension forces dominate to control the liquid/liquid system configuration in a fashion analogous to a liquid/gas system in a zero gravity environment. Author

N72-22272*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PREDICTING SPACECRAFT SELF-CONTAMINATION IN SPACE AND IN A TEST CHAMBER
John J. Scialdone *In its* Space Simulation 1972 p 349-360 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

The self-contamination of a spacecraft, defined as the return and deposition of outgassed molecules on its critical surfaces, was investigaed. Theoretical relations for the flux, density, and pressure of the emitted gas as a function of altitude, radius, and distance from the spacecraxt surface were developed. The flux of these outgassed molecules which return to the emitting surface was also obtained and shown to be dependent on altitude, dimensions, and on the magnitude of outgassing. The rate of vondensation and the time for the formation of a monolayer of the rzturning molecules can be calculated. The self-contamination of a spacecraft undergoing vacuum chamber test was also analyzed and compared to the equivalent parameters for the orbital conditions. Author

N72-22273*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
PREPARATION, VERIFICATION, AND OPERATIONAL CONTROL OF A LARGE SPACE-ENVIRONMENT-SIMULATION CHAMBER FOR CONTAMINATION SENSITIVE TESTS
James T. Visentine, John W. Ogden, Melvin L. Ritter (Brown and Root, Inc.), and Charles F. Smith *In its* Space Simulation 1972 p 361-388 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

A 2-year program to prepare chamber A at the NASA Manned Spacecraft Center for Apollo telescope mount thermal-vacuum tests is discussed. This program covers modification to existing chamber systems, the development of facility and chamber operating procedures, the selection of chamber cleaning and control methods, and the development and evaluation of diagnostic instrumentation. Extensive efforts to ensure a minimum contamination environment for the Apollo telescope mount test series are illustrated. Recent thermal-vacuum tests of this chamber at progressive stages of cleanliness have demonstrated the success achieved in reducing the particulate and molecular contamination levels of the basic chamber interior. Author

N72-22274*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
V-3 CONTAMINATION TEST IN THE MANNED SPACECRAFT CENTER'S VACUUM CHAMBER-A
Philip W. Tashbar, Daniel B. Nisen, and W. Walding Moore, Jr. *In its* Space Simulation 1972 p 389-403 (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

The V-3 contamination test was designed to measure the degree to which the vacuum facility might be a source of contamination. One test measurement subsystem consisting of a quadrupole residual gas analyzer, a quartz crystal microbalance, and an ion gage is described. Author

N72-22275*# National Research Corp., Cambridge, Mass.
THE DETERMINATION AND OPTIMIZATION OF (RUTILE) PIGMENT PARTICLE SIZE DISTRIBUTIONS c18
L. Willard Richards *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 409-423 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 11C

A light scattering particle size test which can be used with materials having a broad particle size distribution is described. This test is useful for pigments. The relation between the particle size distribution of a rutile pigment and its optical performance in a gray tint test at low pigment concentration is calculated and compared with experimental data. Author

N72-22276*# Aerospace Corp., El Segundo, Calif.
SATELLITE TEMPERATURE CORRELATION OF PREDICTED, TEST, AND FLIGHT DATA c31
H. Apoian *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 425-443 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 20M

This study compares satellite temperature predictions with thermal vacuum test results and shows the improvement from testing. Orbital data were compared with prediction/test results to determine quantitatively an expected error criteria. Author

N72-22277*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
EFFECTS OF SURFACE BUBBLES ON HEAT-TRANSFER CHARACTERISTICS OF SPACECRAFT PAINTS c18
Reagan S. Redman *In its* Space Simulation 1972 p 445-452 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 11C

The characteristics are affected by bubbles, and changes in these characteristics are functions of bubble size and configuration and internal and external bubble environments. Under certain internal bubble environmental conditions, the changes in the heat transfer characteristics were calculated. Author

N72-22278*# Philco-Ford Corp., Palo Alto, Calif.
SPACE SIMULATION AND RATE DEPENDENT RADIATION TESTING c33
H. E. Pollard and D. C. Briggs *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 453-460 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 20M

An environmental test facility is described which allows in-situ measurements for evaluation of near real time sinergistic effevts of combined space environments. Author

N72-22279*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ENVIRONMENTAL SIMULATION TESTING OF SOLAR CELL CONTAMINATION BY HYDRAZINE c03
W. Walding Moore, Jr. *In its* Space Simulation 1972 p 461-468 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 10A

Test results for thermal vacuum and radiation environment simulation of hydrazine contamination are discussed. Solar cell performance degradation, measured by short circuit current, is presented in correlation with the variations used in environmental parameters. Author

N72-22280*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A CONTAMINATION EXPERIMENT INVESTIGATING THE FAILURE OF THE NIMBUS 4 FILTER WEDGE SPECTROMETER c14
Raymond Kruger *In its* Space Simulation 1972 p 469-485 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

A ground test is described wherein a quartz crystal microbalance was used in defining the quantity and direction of a contaminant. The cause of the failure of an experiment in orbit was thus confirmed. Author

N72-22281*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EFFECTS OF SURFACE CONTAMINATION ON THE INFRARED EMISSIVITY AND VISIBLE-LIGHT SCATTERING OF HIGHLY REFLECTIVE SURFACES AT CRYOGENIC TEMPERATURES c23
Walter Viehmann and Alfred G. Eubanks *In its* Space Simulation 1972 p 489-502 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 17E

A technique is described for the simultaneous in situ measurement of film thickness, refractive index, total normal emissivity, visible light scattering, and reflectance of contaminant films on a highly reflective liquid nitrogen-cooled, stainless steel substrate. Emissivities and scattering data were obtained for films of water, carbon dioxide, silicone oil, and a number of aromatic and aliphatic hydrocarbons as a function of film thickness between zero and 20 microns. Water had the greatest effect on emissivity, followed by silicone oil, aliphatic hydrocarbons, aromatic hydrocarbons, and carbon dioxide. Emissivity increased more rapidly with film thickness between zero and 2.5 microns, than at thickness greater than 2.5 microns. Scattering of visible light changed little below 2-microns thickness but increased rapidly with thickness beyond 2 to 3 microns. The effect of contaminant films on passive radiation coolers is discussed. Author

N72-22282*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
AN INSTRUMENT FOR REAL TIME DETECTION OF CONTAMINATION IN SPACE ENVIRONMENTAL TESTS CHAMBERS c14
Robert G. Richmond and Henry N. Harmon (Boeing Co.) *In its* Space Simulation 1972 p 503-519 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

An instrument for in situ vacuum detection of surface reflectance changes at 1216A was designed. Using successive reflections, this instrument is more sensitive as an indicator of reflectance changes than similar instruments having only a single reflection. The selection of each component of the instrument and its operational performance is discussed. Author

N72-22283*# General Electric Co., Philadelphia, Pa. Environmental Sciences Div.
A SPACE SIMULATION TEST CHAMBER DEVELOPMENT FOR THE INVESTIGATION OF RADIOMETRIC PROPERTIES OF MATERIALS
D. L. Enlow *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 523-533 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

The design, fabrication, and preliminary utilization of a thermal vacuum space simulation facility are discussed. The facility was required to perform studies on the thermal radiation properties of materials. A test chamber was designed to provide high pumping speed, low pressure, a low photon level radiation background (via high emissivity, coated, finned cryopanels), internal heat sources for rapid warmup, and rotary and linear motion of the irradiated materials specimen. The radiation detection system consists of two wideband infrared photoconductive dztectors, their cryogenic coolers, a cryogenic-cooled blackbody source, and a cryogenic-cooled optical radiation modulator. Author

N72-22284*# Martin Marietta Corp., Denver, Colo.
THERMAL VACUUM CHAMBER SHROUD PERFORMANCE WITH GASEOUS NITROGEN COOLING
R. A. Farmer *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 535-547 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

The results are presented for calculations of shroud surface temperature for various flow rates of gaseous nitrogen through the liquid nitrogen shrouds of a large thermal vacuum chamber. The conditions imposed provide conservative bounds for Mars surface simulation inside the chamber during thermal testing of an appropriate test object. It is shown that the shroud surfaces seen by the objevt can be held within an acceptable temperature range by providing a reasonable flow of gaseous nitrogen to the shrouds at a reasonable pressure, and that no change to the present shroud sustem need be made which would affect its suitability for liquid nitrogen cooling. Author

N72-22285*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
ADVANTAGES OF CRYOPUMPING WITH LIQUID HYDROGEN INSTEAD OF HELIUM REFRIGERATORS c23
J. W. Anderson and J. E. Tueller *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 549-554 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 20L

Open loop hydrogen vaporizers and helium refrigerators are compared for operational complexity, installation and operating cost, and safety requirements. Data from two vacuum chambers using helium refrigerators are used to provide comparative data. In general, the use of hydrogen is attractive in the larger systems, even when extra safety precautions are taken. Emotional resistance to the use of hydrogen because of safety requirements is considered great. However, the experience gained in the handling of large quantities of cryogenics, particularly hydrogen and liquefied natural gases, should be considered in the design of open loop hydrogen cooling systems. Author

N72-22286*# Hughes Aircraft Co., El Segundo, Calif.
DEVELOPMENT OF A CARBON CLOTH HEAT POST MODULE FOR THERMAL VACUUM TESTING OF A SPINNING SPACECRAFT
M. B. Levine and L. A. Nelson *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 555-563 (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

Development of a high temperature, high power density, isothermal, rapid transient, infrared thermal modqle is described. The investigation of various alternative approaches is discussed, as well as the rationale leading to the choice of a carbon cloth concept. Evolution of module design configurations and a summary of the development test results are included, along with a detailed description of the final design, which incorporated a black plate emitter radiantly heated by the carbon cloth. The final module configuration met design criteria during a 200-hour thermal vacuum performance test at 1000 F operating temperature without contaminating a solar cell array. Author

N72-22287*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE DESIGN AND OPERATION OF A PLANET EMITTED AND ALBEDO RADIATION SIMULATOR
George E. Sweet, John T. Taylor, and Ira H. A. Abbott *In its* Space Simulation 1972 p 565-592 refs (See N72-22250 13-11)
Avail: NTIS; SQD $4.50 as NAS 1-21:298 CSCL 14B

A simulator is described, which provides a dynamic simulation of planetary albedo and planet-emitted thermal radiation. The simulator was designed for model tests of advanced thermal

control concepts, the development of space hardware, and flight qualification of small payloads. The simulator was designed to be used in a vacuum chamber equipped with liquid nitrogen cold walls and a solar simulator. The simulator consists of two major components: a gimbaled model support system and an array of quartz infrared lamps. Tests indicate that the apparatus will satisfactorily simulate the secondary radiation on a 0.92-meter spherical body in near-earth orbits. Calculations indicate that other shapes can be accommodated without structural modifications. Author

N72-22288*# Martin Marietta Corp., Denver, Colo.
SPACECRAFT THERMAL VACUUM TESTING
B. F. Elam and L. D. Lancaster *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 593-612 refs (See N72-22250 13-11)
(Contract NAS8-24000)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

An approach for developing a general thermal vacuum test program philosophy is discussed. Guidelines are established that will assist the project engineer in relating the risk associated with flying any spacecraft to its test program. Computerized techniques can be used to help ascertain these guidelines, which relate the risk to the level of test (component, subsystem, etc), as well as to the type of test (development, qualification, etc). The interrelationship between the test program and the analytical effort is also discussed. The Skylab Apollo telescope mount general thermal vacuum test program, including test schedules, instrumentation, and test results is also discussed. Author

N72-22289*# European Space Technology Center, Delft (Netherlands).
SOME CONTAMINATION PROBLEMS IN THE EUROPEAN TD SATELLITE c31
J. Dauphin, G. Schamle, and A. Zwaal *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 613-627 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 22B

Materials were selected for the European TD satellite with a view to avoiding contamination of its stellar ultraviolet telescopes. Materials were selected using the micro-VCM technique, and some typical cases of materials evaluation are described. The cleanliness of the satellite was monitored during integration and test phases, and in particular during long duration thermal vacuum tests. Author

N72-22290*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MARTIAN GRAVITY SIMULATOR FOR FULL-SCALE VIKING LANDING
Ulysse J. Blanchard and Sandy M. Stubbs *In its* Space Simulation 1972 p 629-646 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

The feasibility of an elastic shock cord suspension system for conducting landing impact investigations of a full scale prototype Mars lander under simulated Martian gravity on Earth was evaluated experimentally. A full size model of an early version of the Viking lander was used to assess the adequacy of the full scale simulator. Results of landing tests at Mars gravity were compared to results obtained during free-body Earth gravity landing of the model. Impact accelerations, landing gear forces and strokes, and behavior during landings were in good agreement. It was established that a simple inexpensive elastic cord suspension system with associated vehicle launching equipment is a practical method for conducting fullscale landing investigations of prototype Mars lander spacecraft. Author

N72-22291*# Martin Marietta Corp., Denver, Colo.
TECHNOLOGY OF PLANETARY EXTREME ENVIRONMENT SIMULATION
M. E. Wakefizld, L. E. Apodaca, and C. A. Hall *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 657-671 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

Four test chamber systems were devleoped to simulate the extreme atmospheric environs of Venus and Jupiter, in order to assure satisfactory performance of scientific entry probes and their experiments. Author

N72-22292*# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
OPERATING CHARACTERISTICS OF THE AIR FORCE FLIGHT DYNAMICS LABORATORY 50 MEGAWATT HYPERSONIC TESTS LEG
J. C. Beachler and W. A. Kachel *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 675-686 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

A 50 megawatt hypersonic arc wind tunnel was developed, with up to 5.0-feet-diameter test sections, for thermostructural tests of lifting entry vehicles. Author

N72-22293*# Toronto Univ. (Ontario).
MOLECULAR BEAM SIMULATION OF PLANETARY ATMOSPHERIC ENTRY: SOME RECENT RESULTS
J. B. French and N. M. Reid (Minnesota Univ.) *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 687-701 refs Sponsored in part by Canadian Defence Res. Board and Natl. Res. Council of Can. Prepared for Martin Marietta Corp. (See N72-22250 13-11)
(Contracts RC1-20170; RC-207000)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

Molecular beam sources for producing fast beams containing CO2 and atomic oxygen are discussed. Results pertinent to the design and calibration of mass spectrometer ion source for measurement of the Martian atmosphere during the free molecule portion of the entry trajectory are also presented. The shortcomings and advantages of the simulation technique are discussed. It is shown that an open cavity configuration retains sensitivity to atomic oxygen, provides reasonable signal enhancement from the stagnation effect, is not highly sensitive to pitch and yaw effects, and presents no unforeseen problems in measuring CO2 or atomic oxygen. The simulation techniques used provide assistance in designing, developing, and (potentially) in testing and calibrating the required flight instrument. Author

N72-22294*# McDonnell-Douglas Co., St. Louis, Mo.
SUPERALLOY MATERIAL TEST IN A PLASMA ARC TUNNEL
D. W. Land *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 703-721 refs (See N72-22250 13-11)
(Contract NAS3-14666-H)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

Seven superalloy models were tested in a plasma arc tunnel at the peak heating condition existing on the space shuttle orbiter's lower surface during a low cross-range entry. The models were 3 x 3 in. flat surfaces, nominally 0.01 to 0.02 in. thick, and were held in a water-cooled wedge holder at a 60 deg angle of attack. Five test models were recycled 25 times for 10 min periods (two were recycled 50 times) in a Mach 4.6 test stream, with the model's leading edge temperature maintained at 2200 F (2000 F in one case). Author

N72-22295*# Dow Corning Corp., Midland, Mich.
DEVELOPMENT OF A SILICONE ABLATOR FOR HIGH-HEAT-FLUX AND HIGH-SHEAR-RATE CONDITION c33
Richard A. Campbell, James A. Ramseyer, and Arnold Huntress *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 725-748 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 20M

A silicone material was developed which gives suitable ablative protection in the high heat flux, high shear environments encountered in severe reentry applications, such as nose cones

for ballistic vehicles and protection of leading edges or other critical areas of a vehicle. In addition, the ease of handling, low application cost, and room temperature cure make such a silicon material suitable nozzles for the large rockets necessary for vehicle launching. The development of this product is traced from the selection of suitable polymers through the choice of fillers and the finalization of filler loadings. Author

N72-22296*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
AN EVALUATION OF FLIGHT DATA FOR THE APOLLO THERMAL PROTECTION SYSTEM c33
E. P. Bartlett (Aerotherm Corp., Mountain View, Calif.) and D. M. Curry *In its* Space Simulation 1972 p 749-768 refs (See N72-22250 13-11)
(Paper-67) Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 20M

A study was conducted to correlate Apollo ablation and thermal response flight data using advanced state-of-the-art analytical procedures. The agreement between flight data and predictions is consistently excellent for in-depth temperature distributions, char density profiles, and surface ablation, thus validating the analytical procedures. Author

N72-22297*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPACECRAFT APPLICATIONS OF QUADRUPOLE MASS SPECTROMETRY c14
Matthew P. Thekaekara *In its* Space Simulation 1972 p 769-785 refs (See N72-22250 13-11)
(Paper-68) Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

Techniques of mass spectrometry are reviewed and the theory of the quadrupole mass spectrometer (QMS) is discussed. The QMS is shown to have several advantages over older types of mass spectrometers. The QMS has been flown on a large number of rockets and several satellites. More sophisticated versions of the QMS are proposed for future satellites. Special emphasis is placed on problems of contamination which are likely to be encountered on a large and complex satellite like the Advanced Technology Satellite ATS-G. The development of a QMS to detect and forestall such contamination is discussed.
Author

N72-22298*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
DIRECTIONAL MOLECULAR FLOW ANALYSIS AND LEAK DETECTION WITH A ROTATABLE GAS ANALYZER IN A LARGE SPACE SIMULATION CHAMBER c14
Horst K. F. Ehlers *In its* Space Simulation 1972 p 789-801 ref (See N72-22250 13-11)
(Paper-70) Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

A system was developed and applied at the NASA Manned Spacecraft Center for measuring and analyzing directional molecular flows in a large thermal vacuum chamber in order to verify molecular environment and identify characteristic and abnormal test article and chamber conditions. The system is described, and some results obtained in over 1200 hours of operation are given. Author

N72-22299*# McDonnell Aircraft Corp., St. Louis, Mo.
RESIDUAL GAS ANALYZER CALIBRATION c14
R. H. Lilienkamp *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 803-814 refs (See N72-22250 13-11)
(Paper-71) Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

A technique which employs known gas mixtures to calibrate the residual gas analyzer (RGA) is described. The mass spectra from the RGA are recorded for each gas mixture. This mass spectra data and the mixture composition data each form a matrix. From the two matrices the calibration matrix may be computed. The matrix mathematics requires the number of calibration gas mixtures be equal to or greater than the number of gases included in the calibration. This technique was evaluated using a mathematical model of an RGA to generate the mass spectra. This model included shot noise errors in the mass spectra. Errors in the gas concentrations were also included in the valuation. The effects of these errors was studied by varying their magnitudes and comparing the resulting calibrations. Several methods of evaluating an actual calibration are presented. The effects of the number of gases in then, the composition of the calibration mixture, and the number of mixtures used are discussed. Author

N72-22300*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A COMPARISON OF QUARTZ CRYSTAL MICROBALANCE MEASUREMENTS WITH MASS SPECTROMETER DETERMINATIONS c14
Raymond Kruger, John J. Scialdone, and Harold Shapiro *In its* Space Simulation 1972 p 815-830 refs (See N72-22250 13-11)
(Paper-72) Avail: NTIS; SOD $4.50 as NAS1-21:298 CSCL 14B

An experimental program was undertaken in which mass accretion rates, as determined by a liquid nitrogen cooled quartz crystal microbalance, were compared with the mass flux rates, as determined by both a cycloidal type and a quadrupole type residual gas analyzer for five simple materials. The data indicate a high degree of correlation between these instruments insofar as the shape of the curves. There are large variations however among the absolute values. Author

N72-22301*# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Labs.
A VACUUM THERMOGRAVIMETRIC METHOD FOR OUTGASSING EVALUATIONS OF SILICONE-COATED FIBERGLASS CLOTH c18
L. B. Jensen, G. B. McCauley, M. Honma, and A. E. Hultquist *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 831-841 refs (See N72-22250 13-11)
(Paper-73) Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 11D

A method for evaluating outgassing characteristics of space-sensitive materials was devised by modifying a thermogravimetric balance so that a continual weight loss trace is obtained as a function of time at constant temperature and nearly constant pressure. In addition the apparatus is capable of collecting room temperature condensibles during the outgassing run. A series of silicone-coated glass cloth samples were evaluated by this method. The major advantage of the technique is that data presentation is developed in the form of a continuous trace. This data can then be utilized to develop the kinetics of weight loss. The technique has been shown to be a useful and valid one for indicating small differences between materials under vacuum and elevated temperature conditions.
Author

N72-22302*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PREDICTION OF THE MECHANICAL PROPERTIES OF A FILLED ELASTOMER IN VACUUM c18
Gerald L. Gregory *In its* Space Simulation 1972 p 843-857 refs (See N72-22250 13-11)
(Paper-74) Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 11D

Constant force creep measurements were made at three stress levels on samples of an ammonium perchlorate filled butadiene-acrylic acid copolymer in vacuum and in the atmosphere (air, 50% relative humidity) at a temperature of 28 C. The creep compliance of the samples decreased as much as 50% after 14 days of vacuum exposure. Shift factors were developed which, when applied to the atmospheric compliance measurements,

predicted the behavior in vacuum. The experimental results led to the following conclusions: (1) shift factors can be applied to predict compliance behavior in vacuum from measurements in air, and (2) the shift factors are independent of stress but increase in magnitude with increasing vacuum exposure. Author

N72-22303*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ACCELERATED TESTING OF A FILLED ELASTOMER IN VACUUM c18
Morris L. Evans (Va. Polytechnic Inst.), Thomas C. Ward (Va. Polytechnic Inst.), and Gerald L. Gregory *In its* Space Simulation 1972 p 859-873 refs (See N72-22250 13-11)
(Paper-75) Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 11D

A program was conducted to evaluate an in situ dynamic modulus measurement on a solid propellant exposed to vacuum environment. The prediction of long-term vacuum exposure effects is examined. Author

N72-22304*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
CHANGES IN SOME PHYSICAL PROPERTIES INDUCED BY VACUUM HEAT TREATMENT c15
A. E. Hultquist *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 875-879 ref (See N72-22250 13-11)
(Paper-76) Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 13H

A method is proposed for reducing or eliminating outgassing of materials by heat treating them in vacuum prior to use. This may be performed on the raw material prior to manufacturing and installation or after fabrication of parts. Processing of a fabricated part can be performed only on relatively small parts and on assemblies containing no components which are affected by the required temperatures and pressures. Processing conditions of temperature and time are dependent on the particular application and the materials involved. Silicone-coated fiber glass cloth was vacuum-heat treated for 100 hrs at 400 + or - 25 F at pressures of 0.001 torr or less. The materials were tested in terms of tensile strength and tear properties in both the smooth and several creased configurations. Data obtained on one side silicone coated fiber glass showed large reductions in these properties as a result of the vacuum-heat treatment. The problem was alleviated by coating both sides of the fiber glass. Author

N72-22305*# McDonnell Aircraft Corp., St. Louis, Mo.
THERMAL TESTING TECHNIQUES FOR SPACE SHUTTLE THERMAL PROTECTION SYSTEM PANELS c33
B. G. Cox *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 881-897 (See N72-22250 13-11)
(Contracts NAS8-26115; NAS9-11221)
(Paper-77) Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 20M

An experimental system was developed for evaluation of the effects of aerodynamic heating and cooling, vacuum, and pressure loading on candidate insulation packages proposed for use on the space shuttle. The system includes a number of design features which facilitate rapid recycle times. This is necessary to efficiently conduct extensive thermal cycling tests on these insulation packages to determine their reuse capabilities. The heart of the system is a 26-inch graphite element radiant heater. A susceptor plate functions as a uniform-temperature intermediate radiating surface. The susceptor also forms the lid of an inert atmosphere enclosure which separates the heater from the oxidizing test atmosphere. In some tests the plate properly simulates the heating from an actual flight heat-shield panel. Although other materials were used at lower required test temperatures, 2500 F was routinely achieved using a coated columbium susceptor plate. Author

N72-22306*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STADAN AND DATA RELAY SATELLITE SIMULATION (EMPHASIS ON THE SCHEDULER)
B. Kerne (Operations Res., Inc.), N. Shustermann (Operations Res. Inc.), and P. Pease *In its* Space Simulation 1972 p 899-908 (See N72-22250 13-11)
(Paper-78) Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

A set of computer programs was developed which can be used to simulate the operation of NASA's Satellite Tracking and Data Acquisition Network (STADAN). The simulation consists of two major modules, a computerized algorithmic satellite scheduler (CASS) and a generalized evaluation model simulator (GEMS). CASS generates in-view time intervals of satellites over ground stations, and using these candidate passes, produces a schedule of service times for specific satellites to be serviced by specific ground stations in an attempt to fulfill certain inputted service requirements. GEMS than examines how well STADAN fulfills this schedule in terms of the availability and dependability of different (inputted) complements of equipment at the ground stations. The simulation was modified to allow for the introduction of one or more tracking and data relay satellites, which can serve as orbital receiving and command stations. Author

N72-22307*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SAS ATTITUDE SUPPORT SYSTEM
J. L. Snyder (Computer Sci. Corp., Silver Spring, Md.) and G. F. Meyers *In its* Space Simulation 1972 p 909-931 refs (See N72-22250 13-11)
(Contract NAS5-11790)
(Paper-79) Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

A unique ground control system was designed and implemented to support and meet the stringent mission requirements of the SAS-1. The important features of the system are described with emphasis on the software used to control the orientation of the spacecraft. A summary of the system's operation during the SAS-1 mission is given along with a discussion of the performance of the software subsystems relative to the mission requirements. D.L.G.

N72-22308*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TECHNIQUES ASSOCIATED WITH THERMAL-VACUUM TESTING OF THE OAO-C HEAT PIPES c33
James P. Marshburn *In its* Space Simulation 1972 p 933-946 refs (See N72-22250 13-11)
(Paper-80) Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 20M

The mechanical problems associated with testing the two high-heat load pipes are discussed. One of these pipes was tested three times before being accepted. The first test resulted in the discovery of non-condensable hydrogen gas, which prevented the pipe from functioning properly. The second test was a repeat of the first, to see if all the gas had been removed. The third test was to see if any changes had occurred to the pipe as a result of saddle modifications. Saddle modifications were necessary because the epoxy binding agent between the saddles and the pipe had decomposed during the testing. The test problems discussed deal with the specially designed heat-removal devices, the mobile tilt table, the table position indicator, and the heat input mechanisms, all of which were necessary to conduct a high-heat load, thermal-vacuum test. The final results showed that the techniques used were adequate for thermal-vacuum testing of heat pipes. Author

N72-22309*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RADIATION SCALES ON WHICH STANDARD VALUES OF THE SOLAR CONSTANT AND SOLAR SPECTRAL IRRADIANCE ARE BASED c29
Matthew P. Thekaekara *In its* Space Simulation 1972 p 947-953 refs (See N72-22250 13-11)
(Paper-81) Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL

03B

The question of radiation scales is critically examined. There are two radiation scales which are of fundamental validity and there are several calibration standards and radiation scales which have been set up for practical convenience. The interrelation between these scales is investigated. It is shown that within the limits of accuracy of irradiance measurements in general and solar irradiance measurements in particular, the proposed standard values of the solar constant and solar spectrum should be considered to be on radiation scales of fundamental validity; those based on absolute electrical units and on the thermodynamic Kelvin temperature scale. Author

N72-22310*# Institute of Environmental Sciences, Washington, D.C. Solar Radiation Committee.

PROPOSED SPECIFICATION FOR THE SOLAR CONSTANT AND AIR MASS ZERO SOLAR SPECTRAL IRRADIANCE c29

In NASA. Goddard Space Flight Center Space Simulation 1972 p 955-968 refs Prepared in cooperation with Am. Soc. for Testing and Mater., Philadelphia, Pa. (See N72-22250 13-11)

(Paper-82) Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 03B

The specification defines the solar constant and the zero air mass solar spectral irradiance for use in thermal analysis, thermal balance testing, and other tests of spacecraft and spacecraft components and materials. It is based upon data from experimental measurements made from high altitude aircraft, balloons, spacecraft, and the earth's surface. The stated accuracies are based on the estimated accuracies of the measurements, calibrations, and radiometric scales. D.L.G.

N72-22311*# Institute of Environmental Sciences, Washington, D.C. Solar Radiation Committee.

RECOMMENDED PRACTICE FOR SOLAR SIMULATION FOR THERMAL BALANCE TESTING OF SPACECRAFT

In NASA. Goddard Space Flight Center Space Simulation 1972 p 969-1057 refs Prepared in cooperation with Am. Soc. for Testing and Mater., Philadelphia, Pa. (See N72-22250 13-11)

(Paper-83) Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

Test requirements and instrumentation are discussed together with a review of general procedures, safety, and maintenance. A term definition listing is included. D.L.G.

N72-22312*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

MECHANISMS FOR THE ADHESION OF SILVER TO GLOW DISCHARGE SENSITIZED PERFLUORINATED ETHYLENE PROPYLENE (PEP) c06

John B. Schutt, William H. Gilchrist, and Frank N. Paczkowski *In its* Space Simulation 1972 p 1059-1071 refs (See N72-22250 13-11)

(Paper-84) Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 07D

Details are given for the deposition of silver onto FEP for a batch coater capable of handling 864 square inches at a time. The effectiveness of the glow discharge is shown to be optimum when the FEP faces the anode. Using solid state theory based upon the work function difference, and the heuristic assumption that the surface of FEP is populated with fluoride ions, it is argued that an anode sensitized surface develops states receptive to electron transfer from silver, whereas a cathode sensitized surface is polarized only, and as a result cannot permanently trap charge. Thermodynamic arguments given show that an order of magnitude of 10 to the 9th power electrons are transferred into states to a depth of 10 nm. Author

N72-22313*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

THE DEEP SPACE NETWORK, VOLUME 8 Progress Report, Jan. - Feb. 1972

15 Apr. 1972 152 p refs

(Contract NAS7-100)

(NASA-CR-126141; JPL-TR-32-1526-Vol-8) Avail: NTIS CSCL 22A

Progress is reported on DSN supporting research and technology, advanced development and engineering, implementation, and operations which pertain to mission-independent or multiple-mission development as well as to support of flight projects. Author

N72-22314# Toronto Univ. (Ontario). Inst. for Aerospace Studies.

[GAS DYNAMICS AND AEROSPACE RELATED RESEARCH] Annual Progress Report, 1970

Nov. 1970 269 p refs

Avail: NTIS

Progress of the current research projects is reported. The work presented includes: diffusive separation in front of blunt bodies in supersonic flows, plasma dynamics, aerodynamics noise, rocket research, space simulation and surface interactions, and sonic boom. A summary of the Seventh International Shock Tube Symposium is also included. F.O.S.

N72-22315*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

ENVIRONMENTAL IMPACT STATEMENT FOR MANNED SPACECRAFT CENTER AND WHITE SANDS TEST FACILITY

Sep. 1971 57 p

(NASA-TM-X-67745; PB-203160-F) Avail: NTIS CSCL 14B

This environment has not only attracted people and increased payrolls, but has also created a broader base for the local economy. The activity of the center was a catalyst to private enterprise and has led to sizeable residential and commercial developments. Adequate treatment of domestic and industrial waste water was maintained. A feasibility study is now being conducted to establish a plan for a coordinated, centerwide plan for advanced treatment of domestic and industrial waste water. Author

N72-22316*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

FLUID FLOW ANALYSIS OF A HOT-CORE HYPERSONIC WIND-TUNNEL NOZZLE CONCEPT

John B. Anders, Daniel I. Sebacher, and William B. Boatright Washington May 1972 26 p refs

(NASA-TN-D-6768; L-8179) Avail: NTIS CSCL 14B

A hypersonic-wind-tunnel nozzle concept which incorporates a hot-core flow surrounded by an annular flow of cold air offers a promising technique for maximizing the model size while minimizing the power required to heat the test core. This capability becomes especially important when providing the true-temperature duplication needed for hypersonic propulsion testing. Several two-dimensional wind-tunnel nozzle configurations that are designed according to this concept are analyzed by using recently developed analytical techniques for prediction of the boundary-layer growth and the mixing between the hot and cold coaxial supersonic airflows. The analyses indicate that introduction of the cold annular flow near the throat results in an unacceptable test core for the nozzle size and stagnation conditions considered because of both mixing and condensation effects. Use of a half-nozzle with a ramp on the flat portion does not appear promising because of the thick boundary layer associated with the extra length. However, the analyses indicate that if the cold annular flow is introduced at the exit of a full two-dimensional nozzle, an acceptable test core will be produced. Predictions of the mixing between the hot and cold supersonic streams for this configuration show that mixing effects from the cold flow do not appreciably penetrate into the hot core for the large downstream distances of interest. Author

N72-22317# California Univ., Berkeley.
ADAPTATION OF MULTI-WIRE PROPORTIONAL CHAMBERS WITH DELAY-LINE READOUTS FOR NEUTRON RADIOGRAPHIC IMAGING
Kenneth Valentine, Selig Kaplan, Leon Kaufman, and Victor Perez-Mendez Nov. 1971 5 p refs Presented at Nucl. Sci. Symp., San Francisco, 3 Nov. 1971
(Contract W-7405-eng-48)
(UCRL-20840; Conf-711111-28) Avail: NTIS

A proportional chamber employing delay line readout was adapted for thermal neutron imaging through the use of a boron converter plate as one of the chamber electrodes. A small prototype chamber using natural B for a converter achieved 0.5% thermal neutron detection efficiency and better than 2 mm resolution (10% to 90% knife edge). A converter plate model calculation gave good agreement with the measurements, showing how efficiency and resolution vary with chamber thickness, energy discrimination, and B and Al-overcoating thicknesses. Substitution of B-10 for the natural B would give a five-fold increase in efficiency and the calculations indicate that a further improvement in both efficiency and resolution of up to 50% is achievable in a single plate system. The results of these calculations and a comparison with measurements are presented. Author (NSA)

N72-22318# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Teoreticheskoi i Eksperimentalnoi Fiziki.
INVESTIGATION OF THE ACCELERATION REGIME IN A LINEAR ION ACCELERATOR BY MEANS OF A SPECTROMETER WITH FIXED TUNING
V. A. Batalin, A. A. Kolomiets, and R. P. Kuibida 1970 18 p refs In RUSSIAN; ENGLISH summary
(ITEF-822) Avail: AEC Depository Libraries

A method for obtaining basic parameters of the longitudinal movement of particles in linacs during a beam pulse is described. The results of measurements for the I-2-ITEP PS linac are given. Author (NSA)

N72-22319# Akademiya Nauk URSR, Kharkov. Fiziko-Tekhnicheskii Inst.
PROTON LINEAR ACCELERATOR WITH SMOOTH REGULATION OF ENERGY OF ACCELERATED PARTICLES FROM 3 TO 9 MeV
B. I. Rudyak, V. A. Bomko, and A. P. Klyucharev 1970 13 p refs In RUSSIAN
(KHFTI-70-66) Avail: AEC Depository Libraries

The characteristics and construction of a variable 3.5- to 9.1-MeV proton linear accelerator are described, and the experimental testing of systems of high frequency supplies is discussed. The accelerator was put into service in 1965. NSA

N72-22320# Princeton Univ., N.J. Plasma Physics Lab.
NONLINEAR PROPERTIES OF KINK AND TEARING INSTABILITIES IN TOKAMAKS
P. H. Rutherford and H. P. Furth Dec. 1971 16 p refs Presented at Conf. on Plasma Theory, Kiev, 19-23 Oct. 1971
(Contract AT(30-1)-1238)
(MATT-872; Conf-711016-6) Avail: NTIS

Experimentally observed Tokamak MHD modes have singular surfaces falling into the plasma region and are of the finite resistivity type. Stability boundaries for these modes are presented for typical current profiles; for centrally peaked profiles the higher m modes become stable. At low resisitivity the diamagnetic drift terms become important. It is shown that the tearing instability remains, but the mode now involves a large drift wave component. Stable secondary helical equilibria computed for typical cases and compared with the amplitudes of the observed precursor oscillations. Author (NSA)

N72-22321# Sandia Labs., Albuquerque, N.Mex. Heat, Plasma, Climatic Div.
DESCRIPTION AND OPERATING CHARACTERISTICS OF THE SANDIA LABORATORIES HEAT FACILITY
G. J. Hartman, P. H. Adams, and A. V. Farnsworth, Jr. Oct. 1971 37 p Sponsored by AEC
(SC-M-710510) Avail: NTIS

Description of the Sandia high enthalpy arc tunnel facility includes details of the vortex-stabilized dc arc heaters, the cooling water systems, the 5-MW dc power supply, and the vacuum system. The nominal operating envelopes for the facility with 4-inch, 8-inch, and 12-inch nozzle exit diameters are presented, and the ability to program a variation in heating rate to a test item is represented by a typical test profile. The computer-controlled data acquisition system used for facility monitoring, as well as for data collection and reduction, is described. Author (NSA)

N72-22322# Institut Franco-Allemand de Recherches, St. Louis (France).
WEAR SHOCK WAVES: SURVEY OF WORK CARRIED OUT AT ISL IN THE FIELD OF SONIC BOOMS (1961-1970) [ONDES DE CHOC FAIBLES: REVUE DES TRAVAUX EFFECTUES A L'ISL EN MATIERE DE BANG (1961-1970)]
C. Thery, M. Froboese, P. Rigaud, and G. Schultze 29 Jan. 1971 61 p refs In FRENCH
(Contract DRME-70/197)
(ISL-NB-1/71) Avail: NTIS

A test program for the effect of sonic booms and the noise of military weapons is reported. The origin of the shock waves generated by supersonic aircraft is recalled and the signal on the ground is discussed including deformations due to stratification or turbulence in the atmosphere, focussing due to acceleration in level flight or flying in a curve, and the influence of the ground form and reflection factor. The N-wave generator available at Saint-Louis (France) is described. A first series of test results to evaluate damage caused by sonic boom to buildings and living bodies (rats) is presented. A bibliography of reports issued during this project is included. ESRO

N72-22323# Institut Franco-Allemand de Recherches, St. Louis (France).
THE SONIC BOOM GENERATOR AT ISL [LE GENERATEUR DE BANG DE L'ISL]
C. Thery, A. Peter, and F. Schlosser 28 Jun. 1971 43 p refs In FRENCH
(Contract DRME-69/34)
(ISL-15/71) Avail: NTIS

In order to study the physiological effects of sonic booms on animals and effects on structures during supersonic aircraft flight, a boom generator was built at ISL, France. This generator, comprising a 189 m shock tube, is described. Its technical and performance characteristics are presented and discussed. N-shape shock waves of 300 and 100 ms duration, and 0.5 to 50 mb intensity could be generated and reflected. The first tests were achieved at the end of December 1970. ESRO

N72-22324# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LUNOKHOD-1: MOBILE LABORATORY ON THE MOON
A. P. Vinogradov 5 Nov. 1971 225 p refs Transl. into ENGLISH of the book "Peredvizhanya Laboratori ya na Lune Lunokod-i" Moscow, Izd-vo Nauka, 1971 p 1-128
(AD-736486; FTD-MT-24-1022-71) Avail: NTIS CSCL 22/2

The book contains a description of the automatic station 'Luna-17' and of the 'Lunokhod-1,' as well as descriptions of the flight of the station and its landing. Problems of controlling the station during the flight and landing and also the control of Lunokhod operation during accomplishment of the research program are also considered. The 'Lunokhod-1' was continuing its travel and its scientific research at the moment when this manuscript was sent to press; therefore only brief preliminary results of the research are presented in the book. Author (GRA)

N72-22325# Aerospace Corp., El Segundo, Calif.
A FLOW-TUBE FACILITY FOR MOLECULAR SPECTROSCOPY Research Report, Jul. 1970 - Sep. 1971
Edwin A. Fives 15 Jan. 1972 28 p refs
(Contract F04701-71-C-0172)
(AD-736444; TR-0172(2220-20)-4; SAMSO-TR-72-6) Avail: NTIS CSCL 14/2

The report describes the design, construction, and operation of a flow-tube facility in which quantitative spectroscopic measurements of emission from molecular reactions relevant to infrared radiation from rocket exhaust plumes can be performed. A brief summary of experiments on plume reactions is included.
Author (GRA)

N72-22326# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SIMULATION OF VISCOUS HYPERSONIC FLOWS IN WIND TUNNELS
V. S. Galkin and V. S. Nikolayev 23 Nov. 1971 16 p refs
Transl. into ENGLISH from Uch. Zap. TsAG (USSR), v. 1, no. 4, 1970 p 26-33
(AF Proj. G101)
(AD-735646; FTD-MT-24-1514-71) Avail: NTIS CSCL 14/2

Analysis of problems involved in direct wind-tunnel simulation of natural interactions between a hypersonic viscous flow and a laminar boundary layer on a plate positioned at zero angle of attack is examined. Direct simulation implies the possibility of relating the experimental data directly to the natural conditions. Calculated data are given for the effects of individual similarity parameters on the lift and drag coefficients, and practical recommendations are included for relating the results of wind-tunnzl experiments to natural situations.
GRA

N72-22327# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
EVALUATION OF DOW CHEMICAL COMPANY EXTRUDED ALUMINUM TWO-PIECE 2 FT BY 12 FT LANDING MAT, MX18-D Final Report
Dewey W. White, Jr. Dec. 1971 61 p refs
(DA Proj. 1G6-64717-DH-01)
(AD-735345; AEWES-MISC-Paper-S-71-2) Avail: NTIS CSCL 01/5

The investigation reported was conducted to evaluate an extruded aluminum alloy landing mat (designated MX18-D) designed and extruded by the Dow Chemical Company, Midland, Michigan. The mat is a 2 by 12-ft, two-piece partially hollow 6061-T6 aluminum alloy panel. (Two 12-in.-wide extrusions are welded together along their longitudinal edges to form a 2-ft-wide wide panel.) The panels are interlocked along the sides by a hinge-type connector, the components of which are an integral part of the basic panel extrusion. Extruded aluminum edge connectors are welded to the basic panel and consist of an overlap and underlap section secured by a locking bar after individual panels have been joined together. This investigation consisted of engineering traffic tests to evaluate the design and performance of the Dow MX18-D mat for compliance with criteria specified in the Department of the Army approved Qualitative Materiel Requirement (QMR) for Prefabricated Airfield Surfacings.
Author (GRA)

N72-22328# ARO, Inc., Arnold Air Force Station, Tenn.
WIND TUNNEL INVESTIGATION OF THE TRANSONIC AERODYNAMIC CHARACTERISTICS OF A FULL-SCALE FLIGHT PATH ACCELEROMETER (FOLLOW-ON TEST) Final Report
T. O. Shadow AEDC Feb. 1972 41 p refs
(Contract F40600-72-C-0003; AF Proj. 6903; ARO Proj. PC0216)
(AD-736456; AEDC-TR-72-1; ARO-PWT-TR-71-232) Avail: NTIS CSCL 14/2

A wind tunnel investigation was conducted on a full-scale flight path accelerometer (FPA), to eliminate shock interaction effects between the angle-of-attack and sideslip vanes and to determine angle-of-attack and angle-of-sideslip vane position errors. The shock interference effects were controlled by increasing the axial separation distance between the angle-of-attack and sideslip vanes.
Author(GRA)

N72-22329# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
WEAPONS SYSTEMS PERSHING SUPPORT Quarterly Progress Report, 1 Apr. - 30 Jun. 1971
1971 9 p refs
(Contract N00017-62-C-0604)
(AD-736154; APL-WQR-C/71-2) Avail: NTIS CSCL 16/4

The report reviews the work of the Applied Physics Laboratory in support of the Pershing program for the period of 1 April through 30 Jun 1971. In this volume results are reported on work in the following category: Synopsis of Pershing Branch activities during Phase 2 of Pershing Weapon System Operational Test Program.
GRA

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N72-22330# National Research Council of Canada, Ottawa (Ontario).
POTENTIAL FLOW CALCULATIONS FOR ARBITRARY AXISYMMETRIC BODIES
R. J. A. Dufault and D. H. Henshaw Nov. 1971 77 p refs
(NRC-NAE-LR-556; NRC-12468) Avail: NTIS

A very general method is presented for calculating incompressible potential flow about arbitrary axisymmetric bodies. It has been coded for a modern TSS computer system. Potential flow at any angle of attack can be computed with or without suction through the body surface - features which render the method of considerable interest for application to such bodies as jet engine nacelles. The coding is of general interest because of its logical arrangement as well as for the procedures used in the calculation of the elliptic integrals and the method of equation solution. The refinements to integrals for the singular elements are new.
Author

N72-22331*# Scientific Translation Service, Santa Barbara, Calif.
ACOUSTICAL CONTROL OF TURBULENT EXCITATION IN FREE JETS
O. Wehrmann Washington NASA Apr. 1972 17 p refs
Transl. into ENGLISH from "Akustische Steuerung der Turbulenten Anfachung im Freistrahl", Wissenschaftliche Gesellschaft fuer luftfahrt, 1957 yearbook, p 102-108
(Contract NASw-2035)
(NASA-TT-F-14257) Avail: NTIS CSCL 20D

Experiments in the boundary layer of a free jet behind a nozzle, at Reynolds numbers up to 20,000 are discussed. The possibility of influencing the conditions of flow acoustically are realized during measurements employing the hot-wire method, primarily which form downstream behind the nozzle initiate the state of fully developed turbulence and can be assessed, in accordance with the hot-wire method by four characteristic properties.
Author

N72-22332# Weapons Research Establishment, Salisbury (Australia).
AN ENGINEERING DESIGN PROCEDURE FOR THE VELOCITY AND TEMPERATURE IN A SUPERSONIC FREE JET
G. Higginbottom Sep. 1971 35 p refs

(WRE-TN-480(WR/D)) Avail: NTIS

A semiempirical design procedure which gives the velocity and temperature at any point in an axisymmetrical supersonic air jet exhausting into still air is described in detail. The procedure takes into account the nozzle outlet angle and the pressure and temperature of the exhausting jet relative to the environmental conditions; thus, it applies to contoured or conical nozzles, and underexpanded or overexpanded, hot or cold jets. Velocities predicted by the method compare well with experimental results of tests on moderately underexpanded and overexpanded jets exhausting at a Mach number of 3.0 from a contoured nozzle. In these tests the plenum chamber temperature was always approximately equal to atmospheric, so that the total temperature throughout each jet was approximately equal to atmospheric. No checks have been made on the accuracy of the method applied to hot jets. Author

N72-22333# National Aerospace Lab., Tokyo (Japan).
ON THE THEORY OF FREE STREAMLINES PAST ARBITRARY OBSTACLES
Hitoshi Takahashi Sep. 1971 15 p refs In JAPANESE; ENGLISH summary
(NAL-TR-247) Avail: NTIS

Free streamline theory was used for obtaining pressure distribution on an airfoil with flow separation. The theory of a free streamline past a circular cylinder was extended to the case of an arbitrary obstacle by a numerical method. Flow velocity along the free streamline is assumed to be equal to the free stream velocity. The classical method of calculation was used and correction was made to introduce the effects of base pressure. Examples are presented for the computations of circular cylinders and airfoils with several base pressures, and fair agreement was obtained between theory and experiment. Author

N72-22334# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
FUNDAMENTAL RESEARCH INTO TWO-STREAM PROPULSION SYSTEMS
Jean-Louis Solignac and Jean Delery 1972 30 p refs In FRENCH; ENGLISH summary Presented at 14th Ann. Israeli Conf. on Aviation and Astronaut., Tel Aviv-Haiffa, Israel, 1-2 Mar. 1972
(ONERA-TP-1050) Avail: NTIS

The sonic range of the primary injector was studied by interferometry. The axisymmetric test models covered a series of convergence angles varying between 2 and 90 deg. The results permit specification of the influence of geometric factors on the discharge coefficient. A simplified method was established for the determination of the initial data necessary to calculate the primary stream. Reattachment of the supersonic turbulent jet on the ejector shroud was also studied. The tests covered a range of separation Mach numbers between 1.94 and 4.2 for geometric expansion ratios of the axisymmetric jet varying from 1.2 to 6. The axisymmetry effect on the angular reattachment law was defined and the wall pressure distribution in the reattachment region determined. Author

N72-22335*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TURBULENT-BOUNDARY-LAYER DEVELOPMENT ON A MOVING GROUND BELT OF ROUGH TEXTURE
Alan T. Roper and Garl L. Gentry, Jr. Washington Apr. 1972 28 p refs
(NASA-TM-X-2515; L-7845) Avail: NTIS CSCL 20D

The equations presented can be used to predict the shape factor and the ratio of the momentum thickness to the relative momentum thickness with reasonable accuracy for a moving ground belt provided that the stationary quantities are known and the two following basic approximations are valid: (1) Shape factor based upon velocity relative to the ground belt is nearly independent of the ratio of belt velocity to free-stream velocity. (2) The ratio of moving-belt momentum thickness to stationary-belt momentum thickness is independent of the coordinate measured in the streamwise direction. In addition, the integral quantities, momentum thickness and displacement thickness, can be predicted for the moving ground belt by using an empirically determined polynomial whose coefficients will change with different belt roughnesses. Author

N72-22336*# Aerotherm Corp., Mountain View, Calif.
BOUNDARY CONDITION COMPUTATIONAL PROCEDURES FOR INVISCID, SUPERSONIC STEADY FLOW FIELD CALCULATIONS
Michael J. Abbett 30 Nov. 1971 97 p refs
(Contract NAS2-6341; Proj. 6147)
(NASA-CR-114446; Rept-71-41) Avail: NTIS CSCL 20D

Results are given of a comparative study of numerical procedures for computing solid wall boundary points in supersonic inviscid flow calculatons. Twenty five different calculation procedures were tested on two sample problems: a simple expansion wave and a simple compression (two-dimensional steady flow). A simple calculation procedure was developed. The merits and shortcomings of the various procedures are discussed, along with complications for three-dimensional and time-dependent flows. Author

N72-22337# Joint Publications Research Service, Arlington, Va.
WAVES AT THE SURFACE OF A FLOW OF FINITE DEPTH EXCITED BY AN UNDERWATER SOURCE
A. A. Zaytsev 30 Mar. 1972 5 p refs Transl. into ENGLISH from Dokl. Akad. Nauk (Moscow), v. 201, no. 5, 1971 p 1070-1073
(JPRS-55584) Avail: NTIS

Wave motion is examined for the surface of a flow of ideal heavy liquid of constant depth, moving in the direction of the positive x-axis. A rectangular coordinate system was chosen such that the plane XOY coincides with the undisturbed liquid level, while the OZ-axis is vertical. The waves were excited by a periodically acting point source. Author

N72-22338*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
APPARATUS AND METHOD FOR GENERATING LARGE MASS FLOW OF HIGH TEMPERATURE AIR AT HYPERSONIC SPEEDS Patent Application
William B. Boatright, inventor (to NASA) Filed 9 Mar. 1972 18 p
(NASA-Case-LAR-10578-1; US-Patent-Appl-SN-233098) Avail: NTIS CSCL 20D

A method and equipment are described for generating high temperature, high mass flow, and high Reynolds number test air flow in the Mach number 8-10 range by pressurizing a ceramic-lined storage tank with air preheated by an electric arc heater and then rapidly releasing the stored air through a Mach 8-10 nozzle. NASA

N72-22339*# Princeton Univ., N.J.
AN EXPERIMENTAL INVESTIGATION OF TURBULENT BOUNDARY LAYERS ALONG CURVED SURFACES
Ronald M. C. So and George L. Mellor Washington NASA Apr. 1972 270 p refs
(Grant NGR-31-001-074)
(NASA-CR-1940; ASM-979) Avail: NTIS CSCL 20D

A curved wall tunnel was designed, and an equilibrium turbulent boundary layer was set up on the straight section preceding the curved test section. Turbulent boundary layer flows with uniform and adverse pressure distributions along convex and concave walls were investigated. Hot-wire measurements along the convex surface indicated that turbulent mixing between fluid layers was very much reduced. However, the law of the wall held and the skin friction, thus determined, correlated well with other measurements. Hot-wire measurements along the concave test wall revealed a system of longitudinal vortices inside the boundary layer and confirmed that concave curvature

enhances mixing. A self-consistent set of turbulent boundary layer equations for flows along curved surfaces was derived together with a modified eddy viscosity. Solution of these equations together with the modified eddy viscosity gave results that correlated well with the present data on flows along the convex surface with arbitrary pressure distribution. However, it could only be used to predict the mean characteristics of the flow along concave walls because of the existence of the system of longitudinal vortices inside the boundary layer. Author

N72-22340*# TRW Systems Group, Redondo Beach, Calif.
ANALYSIS OF FLIGHT DATA ON BOUNDARY LAYER TRANSITION AT HIGH ANGLES OF ATTACK
Wayne W. Haigh, Bruce M. Lake, and Denny R. S. Ko Washington NASA Apr. 1972 165 p refs
(Contract NAS1-10078)
(NASA-CR-1913; TRW-17181-6002-R0-00) Avail: NTIS CSCL 20D

Boundary layer transition data were obtained on the flight of two cones which reentered at velocities of about 7.0 km/sec. One cone reentered at a nominal zero degree angle of attack and the other, due to an anomaly above the earth atmosphere, reentered at local angles of attack up to 7.0 km/sec. The transition data were obtained from on-board acoustic and electrostatic sensors. A description of the design, calibration, and method used to detect transition from the sensors is included. The flow field calculation used to obtain the local flow properties on the cones is described. Finally, the transition data found from both cone flights is correlated. Author

N72-22341# Deutsche Forschungs- und Versuchsanstalt fuer Luxt- und Raumfahrt, Porz (West Germany). Inst. fuer Angewandte Gasdynamik.
ON THE STABILITY OF CLOSED BOUNDARY-LAYER SEPARATION REGIONS ON SPIKED BODIES AT HYPERSONIC FLOW CONDITIONS
H.-P. Kabelitz 7 Oct. 1971 122 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-77) Avail: NTIS; DFVLR, Porz-Wahn: 33,40 DM

Stability boundaries for separated regions on spiked conical bodies were investigated theoretically and experimentally for hypersonic flow conditions. The calculation of stability boundaries was performed by a perturbation method applied to a simplified model of the stationary separated flow. Varying the geometry of spiked conical bodies of different types of stationary and instationary flow were observed in a gun tunnel. Comparison between observed and calculated stability boundaries shows a good qualitative, and for certain conditions a good quantitative agreement. Author

N72-22342*# Translation Consultants, Ltd., Arlington, Va.
THE EXCITATION OF TURBULENCE IN SEPARATED LAMINAR BOUNDARY LAYERS
P. Freymuth Washington NASA Apr. 1972 64 p refs Transl. into ENGLISH of "Ueber die Anfachung von Stoerungen in abgeloesten Laminaren Grenzschten", West German Rept. DLR-FB-66-02 Jan. 1966 p 1-63
(Contract NASw-2038)
(NASA-TT-F-14197; DLR-FB-66-02) Avail: NTIS CSCL 20D

The growth of turbulence in separated laminar boundary layers as a function of the hydrodynamic characteristics numbers for high Reynolds numbers is discussed. The experiments showed that only the Strouhal number has an effect on the spatially growing disturbances. The basic equations of the process were simple, and the theoretical results were in good agreement with the experiments. Author

N72-22343# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
PRODUCTION OF THE JET-TARGET FROM CONDENSED HYDROGEN IN VACUUM
V. D. Bartenev, A. I. Valevich, Yu. K. Pilipenko, and V. V. Smelyanskii 1971 19 p refs In RUSSIAN
(JINR-P13-6058) Avail: AEC Depository Libraries

The development of the technique of jet-target production is discussed. An experimental dzvice is described which produced a jet of hydrogen of diameter 8 to 13 mm and a density of about 0.000001 g/cc. The jet was very well observed visually and recorded by camera. The jet-target was obtained in the Joint Institute for Nuclear Research. Author (NSA)

N72-22344# Colorado State Univ., Fort Collins. Fluid Dynamics and Diffusion Lab.
WIND TUNNEL STUDY ON GASEOUS MIXING DUE TO VARIOUS STACK HEIGHTS AND INJECTION RATES ABOVE AN ISOLATED STRUCTURE
R. N. Meroney and B. T. Yang Nov. 1971 47 p refs
(Contract AT(11-1)-2053)
(CER71-72RNM-BTY16; COO-2053-6) Avail: NTIS

A systematic study of gaseous dispersion about an isolated building structure was conducted. In order to estimate the maximum ground concentration distribution, the conventional formulas were compared with the wind tunnel results. Different stack heights were monitored both by smoke visualization and quantitative concentration measurements. The related parameters such as building orientation, stack height, and exit momentum are discussed. The experiment was conducted in a thick, neutral boundary layer, and Kr-85 was used as a tracer for concentration measurements. Author (NSA)

N72-22345# Mound Lab., Miamisburg, Ohio.
METHODS FOR DETERMINING THE VISCOSITY OF HETEROGENEOUS SYSTEMS
H. Pfoertner 14 Dec. 1971 49 p refs Transl. into ENGLISH from the German report ICT-12/70
(Contract AT(33-1)-GEN-53)
(MLM-1881(TR); ICT-12/70) Avail: NTIS

Difficulties in measurement technique are discussed in connection with the determination of the viscosity of suspensions, using examples from the fields of explosives and solid rocket fuels. Measurement methods were worked out, by means of comparative studies, for various ranges of viscosity, methods which generally provide reliable formulas for the rheological properties of such heterogeneous mixtures. Studies were made of four dispersion systems covering a large range of viscosities. Author

N72-22346# Los Alamos Scientific Lab., N.Mex.
NEW MODEL OF FLUIDS
Gerald I Kerley Dec. 1971 23 p refs
(Contract W-7405-eng-36)
(LA-4760) Avail: NTIS

The thermodynamic properties of a fluid were determined from the zero temperature isotherm of the solid, the excess Helmholtz free energy for hard spheres, and the hard sphere radial distribution function. The model makes no assumption of additive pair potentials between atoms. The fluid is assumed to be a mixture of solidlike clusters, with a density distribution related to the radial distribution function. The average energy of a fluid atom was calculated by integrating over all cluster densities. An effective hard sphere packing fraction, a variable that characterizes a family of fluid structures, was determined by minimizing the Helmholtz free energy. The model requires no experimental data for its application. The theory gives excellent results when compared with experimental data for argon and hydrogen. Author

N72-22347# Institut Franco-Allemand de Recherches, St. Louis (France).
ENTROPY WAKE ANALYSIS OF HYPERSONIC SPHERES [ANALYSE DU SILLAGE D'ENTROPIE DE SPHERES HYPERSONIQUES]
H. Royer 21 Aug. 1970 23 p refs In FRENCH
(ISL-16/70) Avail: NTIS

The wakes of spheres were studied using schlieren photography and amplitude subtraction in the velocity range 3000 to 5500 m/sec and the air pressure range from 25 to 100 mm mercury. Optical path gradients behind the wakes were measured. The distribution of the values of the refractive index as a function to the distance from the wake axis was calculated assuming axial symmetry, yielding an apparent diameter for the wake at several different velocities. ESRO

N72-22348# Institut Franco-Allemand de Recherches, St. Louis (France).
BIBLIOGRAPHICAL STUDY OF HYPERSONIC CONE WAKE TRANSITION [ETUDE BIBLIOGRAPHIQUE COMPAREE DE LA TRANSITION DU SILLAGE D'UN CONE EN VOL HYPERSONIQUE]
J. Gandemer and B. C. Jaeggy 2 Mar. 1971 64 p refs In FRENCH
(Contract DRME-70/197)
(ISL-NB-3/71) Avail: NTIS

A bibliographic survey of the wake transition of blunt cones in hypersonic flow was made with the aim of finding simple criteria that could be easily applied by experimenters who were not aerodynamicists. A study of the criteria of Levenstein, Zeiberg, Wilson, Pallone and Waldbusser led to the choice of this last criterion for application to slender blunt cones, the Zeiberg criterion being applied to spheres. ESRO

N72-22349# Institut Franco-Allemand de Recherches, St. Louis (France).
MECHANICAL STUDY OF THE HYPERSONIC WAKE OF A BLUNT CONE [ETUDE MECHANIQUE DU SILLAGE D'UN CONE EMOUSSE EN VOL HYPERSONIQUE]
B. C. Jaeggy and J. P. Hancy 26 Apr. 1971 38 p refs In FRENCH
(Contract DRME-70/197)
(ISL-9/71) Avail: NTIS

Conditions for the existence of the transition from laminar flow to turbulent flow in the wakes of slender cones (half angle 12.5 dzg radius ratio 0.2) were studied. The distances from the transition point to the stem of the cone were compared with those predicted using the Waldbussez criterion. The results suggest an influence of the radius ratio of the cone which has not yet been established. ESRO

N72-22350# Aerospace Corp., El Segundo, Calif. Aerodynamics and Propulsion Research Lab.
LAMINAR FLAMESHEET WITH HYPERSONIC VISCOUS INTERACTION Report for Aug. 1970 - Aug. 1971
John W. Ellinwood and Harold Mirels 15 Sep. 1971 23 p refs
(Contract F04701-71-C-0172)
(AD-735304; TR-0172(2240-10)-1; SAMSO-TR-71-315) Avail: NTIS CSCL 20/4

A laminar flamesheet model is studied. Fuel is assumed to be injected through a semi-infinite flat plate into a hypersonic stream of oxidizer and diluent. The heat release is assumed sufficient to induce a significant pressure interaction between the hypersonic and laminar flows. Only self-similar flows are considered, and numerical results are obtained for the case of an insulated porous plate with full wall slip. GRA

N72-22351# Oklahoma State Univ., Stillwater.
LASER DOPPLER VELOCIMETER MEASUREMENTS IN A TURBULENT JET EXITING INTO A CROSS FLOW Final Report, Jun. 1970 - Jun. 1971
Dennis K. McLaughlin Arnold AF Station, Tenn. AEDC Jan. 1972 37 p refs
(Contract F40600-70-C-0005)
(AD-736028; AEDC-TR-71-262) Avail: NTIS CSCL 20/4

Measurements were made of horizontal and vertical velocity components along the center line plane of a turbulent jet exiting into a cross flow. The dual scatter laser Doppler velocimeter was used in both the continuous wave mode and the individual realization mode. In the latter case, numerical averaging over many individual measurements was used to compute the average velocity components. Encouraging results were obtained which indicate that the laser Doppler velocimeter will become an important tool in the field of experimental fluid mechanics.
Author (GRA)

N72-22352# Stanford Univ., Calif. Dept. of Mechanical Engineering.
LAMINAR FLOW FORCED CONVECTION HEAT TRANSFER AND FLOW FRICTION IN STRAIGHT AND CURVED DUCTS: A SUMMARY OF ANALYTICAL SOLUTIONS
Ramesh K. Shah and A. L. London Nov. 1971 311 p refs
(Contract Nonr-225(91))
(AD-736260; TR-75) Avail: NTIS HC $6.00/MF $0.95 CSCL 20/4

Theoretical laminar flow solutions for heat transfer and flow friction are of importance in the development of compact heat exchangers. Generally the higher the degree of compactness, the lower is the Reynolds number and the greater is the relevance of the theory solutions. In the report these solutions are compiled for twenty one straight ducts and four curved ducts. Some new analytical solutions are obtained by writing a general computer program for three ducts. Application of the analytical solutions to the gas turbine regenerator is discussed. GRA

N72-22353# Naval Postgraduate School, Monterey, Calif.
THE FORMATION OF HYDRAULIC JUMPS IN A ROTATING CONTINUOUSLY STRATIFIED SYSTEM M.S. Thesis
Robert Paul Kurth Sep. 1971 36 p refs
(AD-736118) Avail: NTIS CSCL 20/4

The formation of hydraulic jumps in a rotating, continously stratified, Boussinesq fluid is investigated. A scale analysis indicates that jump formation cases should be separated from nonjump cases by the curve F = (ARo) squared where Ro and F are the initial Rossby and Froude numbers, respectively. Numerical solutions verify the curve up to F = 0.3 and show that A is in the range 6.0 to 7.5. The solutions for F = 1.0 are examined.
Author

N72-22354# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
THE UNDULATING BOUNDARY LAYER UNDER A STAGNATION FLOW
Max G. Scherberg Nov. 1971 29 p refs
(AF Proj. 7063)
(AD-736027; ARL-71-0240) Avail: NTIS CSCL 20/4

In certain types of curved flow boundary layers there appear to exist spanwise periodic secondary flows which produce periodic streamwise striations in erodable surfaces, and in the case of supersonic flow criss-cross striations appear in pliable surfaces. Some experiments with a water jet against a flat surface have indicated that such boundary layers may be essentially spanwise wavy boundary layers. The paper establishes the plausibility of such a boundary layer in the case of irrotational uniform flow against a flat plate segment. The wave length in the boundary layer is estimated and compared to available measured values. GRA

N72-22355# Aerospace Corp., El Segundo, Calif.
RAREFACTION OF VERY HIGH ALTITUDE PLUMES WITH EXTERNAL FLOW
E. Phillip Muntz 15 Jun. 1971 28 p refs
(Contract F04701-71-C-0172)
(AD-736019; TR-0172(2240-10)-2; SAMSO-TR-71-236) Avail: NTIS CSCL 20/4

The study extends the rocket exhaust plume rarefaction scaling of Muntz, Hamel, and Maguire to an external flow. A thrust-altitude map that outlines the various flow regimes was developed. Author (GRA)

N72-22356# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
ENTROPY LAYERS
Gino Moretti and Maurizio Pandolfi Nov. 1971 33 p refs
(Contracts N00014-67-A-0438-0009; DAHC04-69-C-0077; ARPA Order 1442; NR Proj. 061-135)
(AD-736215; PIBAL-71-33) Avail: NTIS CSCL 20/4

The entropy layer on a blunt-nosed cone is analyzed, in view of the difficulties it produces in numerical computations. A rqle is given to determine at what distance from the nose the entropy layer is a given fraction of the shock layer, for a given free stream Mach number. A simple and efficient way of computing flows with strong entropy layer effects is given. It involves inserting two streamlines representing loci of rapid changes in entropy derivatives, and forbidding differentiation across such lines. Author

N72-22357# Purdue Univ., Lafayette, Ind.
FLUID DYNAMICS OF UNSTEADY, THREE-DIMENSIONAL AND SEPARATED FLOWS
D. E. Abbott, J. C. Wu, and F. J. Marshall Oct. 1971 499 p refs
(Proj. SQUID)
(AD-736248) Avail: NTIS HC $6.00/MF $0.95 CSCL 20/4

Presentations covered: dynamic flow in engine inlets; behavior of diffusers with distorted and unsteady inlet conditions; nonlinear, unsteady, inviscid flows; turbulent boundary layers; laminar separation-bubble flow; numerical solution of three-dimensional Navier-Stokes equations; unsteady boundary layer separation; dynamic stall on helicopter rotor blades; numerical solution of unsteady inviscid flow; calculation of turbulent separations in adverse pressure gradients; unsteady velocity field near the leading edge of flat plate; steady and nonsteady boundary layer separation over oscillating airfoils; velocity amplification in forward stagnation flow; wave type vortex generator; numerical solution of time dependent Navier-Stokes equations; laminar supersonic flow over a small rearward facing step; and experimental investigation of turbulent transonic separated flows. A.L.

N72-22358# General Applied Science Labs., Inc., Westbury, N.Y.
A NUMERICAL STUDY OF THE LAMINAR NEAR-WAKE OF AN AXISYMMETRIC BODY IN A SUPERSONIC FLOW Final Technical Report.
Charles Ruger 27 Oct. 1971 107 p refs
(Contract DAAH01-69-C-0792; ARPA Order 1310)
(AD-736385; GASL-TR-763) Avail: NTIS CSCL 20/4

A numerical solution of the laminar, steady near wake of an axisymmetric body in supersonic flow is developed. The body considered is a spherically capped cylinder with a truncated base. The full set of compressible partial differential equations is solved. The numerical approach is a two-step time dependent finite difference procedure similar to that used by Cheng and Allen in two-dimensions. The scheme is the elimination of the viscosity dependent stability condition for the time dependent solution. GRA

N72-22359# Naval Ship Research and Development Center, Bethesda, Md.
LIFTING SURFACES IN POLYMER SOLUTIONS
John H. Wolff and Raphael D. Cahn May 1971 52 p refs
(SF 35421003)
(AD-736174; NSRDC-3653) Avail: NTIS CSCL 13/10

A full-scale hydrofoil and strut combination was tested in the Naval Ship Research and Development Center Towing Tank at the Langley Air Force Base in Hampton, Virginia. Lift and drag forces were measured on the strut-foil combination with and without air ejection and polymer ejection. Lift and drag forces were also measured on the strut and the strut-foil combination in homogeneous polymer solutions in the tank. Test speeds were between 30 and 80 feet per second. The polymer used was poly-ethylene oxide WRS-301 at concentrations in the tank which ranged from 1 to 27 ppmw. Author (GRA)

N72-22360# Aix-Marseilles Univ. (France). Inst. de Mecanique Statistique de la Turbulencz.
SOME DOUBLE AND TRIPLE SPACE-TIME CORRELATION MEASUREMENTS IN A BOUNDARY LAYER Scientific Report, 1969 - 1971
R. Dumas and A. Favre Jun. 1971 50 p refs
(Contract F61052-67-C-0025; AF Proj. 9781)
(AD-736520; AFOSR-72-0277TR; SR-7) Avail: NTIS CSCL 20/4

New measurements of filtered space-time correlation were performed in a turbulent boundary layer for the longitudinal velocity component with space separation longitudinally and normally to the wall. The celerities along stream wise direction are obtained and discussed. The first triple space-time correlations are presented and their pattern explained in terms of Taylor's hypothesis. Author (GRA)

N72-22361# Ohio State Univ. Research Foundation, Columbus.
A FLAT PLATE STUDY OF THE BINARY SCALING OF VISCOUS HYPERSONIC FLOW Final Report, Oct. 1969 - Sep. 1970
D. J. Harney and S. L. Petrie Aug. 1971 52 p refs
(Contract F33615-70-C-1147; AF Proj. 1426)
(AD-736050; AFFDL-TR-71-104) Avail: NTIS CSCL 16/3

The interaction between the inviscid field and the large viscous boundary layer characteristic of hypersonic flow is analyzed from the continuum viewpoint. A variety of similarity parameters are derived to represent the viscous flow over slender bodies. The similitude is described by a binary collision scaling parameter, so that it is possible to apply a binary scaling that transforms density and length in inverse proportion at a fixed velocity and temperature. Experiments at a Mach number near 13 on a thermally controlled copper sharp plate were conducted to examine the wall temperature effects. Because of the wide range of test conditions covered in the experiments, the results provide some insight into viscous similarity when molecular effects begin to appear at the leading edge. GRA

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N72-22362 National Lending Library for Science and Technology, Boston Spa (England).
METHODS FOR FORECASTING GEOPOTENTIAL AND WIND IN THE STRATOSPHERE AND WAYS OF ASSESSING THEM
V. A. Eliseeva [1971] 9 p refs Transl. into ENGLISH from Nauc.-Issled. Cent. SSSR, t. (USSR), v. 75, 1971 p 57-65
(NLL-M-22088-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL Photocopy Coupon

Trial conditions and assessment criteria for predicting geopotential and wind in the stratosphere were defined according to the method of forecasting chosen and its practical use. Two testing and assessing methods are illustrated: one used by Japanese meteorologists in forecasting winds, and the other for geopotential and wind prediction. Author

N72-22363 National Lending Library for Science and Technology, Boston Spa (England).
ON THE RELATION BETWEEN THE TEMPERATURE OF THE ARCTIC BASIN AND PRECIPITATION IN TEMPERATURE AND TROPICAL LATITUDES
O. A. Drozdov and E. I. Girskaja [1970] 9 p refs Transl. into ENGLISH from If. Gl. Geofiz. Observ. (Lengingrad), v. 258, 1970 p 49-55
(NLL-M-22086-(5828.4F)) Avail: Natl. Lending Library, Boston

Spa, Engl.: 1 NLL photocopy coupon

The results of a computer analysis are presented for relationships between temperature in high latitudes and precipitation in lower latitudes from the late 1880's to the 1960's. Correlations are compared for temperatures at two pairs of Arctic stations with precipitation in temperate and tropical latitudes. Data for the cold season were averaged over 5 and 10 years. In general correlation is higher in the winter than in the summer. K.P.D.

N72-22364*# Metropolitan Washington Council of Governments, D.C.

AN EXAMINATION OF APPLICATIONS OF REMOTE SENSING DATA TO METROPOLITAN WASHINGTON COUNCIL OF GOVERNMENTS' PLANNING REQUIREMENTS

Harry J. Mallon, Joan Y. Howard, and Kenneth M. Karch Dec. 1971 65 p refs

(NASA Order W-13318; DI-14-08-0001-12708)

(NASA-CR-126309; USGS-IR-NASA-224; USGS-DO-72-00) Avail: NTIS CSCL 08G

A comprehensive inventory of a series of remote sensing applications for a variety of regional planning programs in metropolitan Washington was undertaken. Examples of application, methods for data utilization, and corresponding photographic illustrations are provided illustrating how remote sensing would prove particularly useful as a unique and/or supplemental data source. Author

N72-22365*# Stanford Univ., Calif. Remote Sensing Lab.

INFRARED SPECTROMETRY STUDIES: SPECTRAL DIGITAL DATA ACQUISITION SYSTEM (1971 VERSION) Final Report (B), phase 4, 1 Oct. 1970 - 30 Sep. 1971

Lee Lu and R. J. P. Lyon 31 Oct. 1971 42 p refs

(Contract NAS9-7313)

(NASA-CR-115523; SU-RSL-71-3) Avail: NTIS CSCL 08G

The construction of the Stanford Spectral Digital Data Acquisition System is described. The objective of the system is to record both the spectral distribution of incoming radiation from the rock samples measured by the spectroradiometer (Exotech Model 10-34 Circular Variable Filter Infrared Spectroradiometer) together with other weather information. This system is designed for both laboratory and field measurement programs. The multichannel inputs (8 channels) of the system are as follows: Ch 1 the Spectro-radiometer, Ch 2 the radiometer (PRT-5), and Ch 3 to Ch 8 for the weather information. The system records data from channel 1 and channel 2 alternately for 48 times, before a fast sweep across the six weather channels, to form a single scan in the scan counter. The operation is illustrated in a block diagram, and the theory of operation is described. The outputs are written on a 7-track magnetic tape with IBM compatible form. The format of the tape and the playback computer programs are included. The micro-pac digital modules and a CIPHER model 70 tape recorder (Cipher Data Products) are used. One of the major characteristics of this system is that it is externally clocked by the spectroradiometer instead of taking data at intervals of various wavelengths by using internal-clocking. Author

N72-22366*# Stanford Univ., Calif. Remote Sensing Lab.

THE 1970/71 SPECTRAL DATA MANAGEMENT PROGRAMS Final Report (A), phase 4: Software (computer programming)

A. A. Marshall Jun. 1971 60 p refs

(Contract NAS9-7313)

(NASA-CR-115522; SU-RSL-TR-71-2) Avail: NTIS CSCL 08G

The data management programs used by the Stanford Remote Sensing Laboratory to access, modify, and reduce the data obtained from both the NASA IR airborne spectrometer, and Stanford's SG-4 field spectrometer are reported. Many details covered in previous reports are not repeated. References are provided. These programs are written in FORTRAN 4 and S/360 Assembler Language, and are currently running on a S/360 model 67 (operating under OS/MFT) at the Stanford Computation Center Campus Facility. Author

N72-22367*# Texas A&M Univ., College Station.

ANALYSIS OF SIMULATED MULTISPECTRAL DATA FROM EARTH RESOURCES SATELLITES

D. A. White, J. W. Rouse, Jr., and J. A. Scheel Sep. 1971 44 p refs Presented at the IEEE 3d Intern. Geosci. Electron. Symp., Washington, D. C., Sep. 1971

(Grant NGL-44-001-001)

(NASA-CR-126245; RSC-35) Avail: NTIS CSCL 08G

The validity of the applicability assumption was determined through the simulation of ERTS and Skylab data using available aircraft scanner systems. The research techniques compared aircraft multispectral scanner data obtained under nominal conditions at low altitudes. Maximum likelihood decision criteria algorithms implemented on a digital computer were used to classify training set data. Comparisons between percentages of correct classifications were made, along with implications as to the techniques of satellite analysis. Author

N72-22368*# Aerojet-General Corp., El Monte, Calif. Space Div.

MICROWAVE RADIOMETRIC STUDIES AND GROUND TRUTH MEASUREMENTS OF THE NASA/USGS SOUTHERN CALIFORNIA TEST SITE

A. T. Edgerton, D. T. Trexler, S. Sakamoto, and J. E. Jenkins Apr. 1969 109 p Original contains color illustrations

(NASA Order W-12570; Contract DI-14-08-0001-11425)

(NASA-CR-126136; USGS-IR-NASA-149) Avail: NTIS CSCL 08G

The field measurement program conducted at the NASA/USGS Southern California Test Site is discussed. Ground truth data and multifrequency microwave brightness data were acquired by a mobile field laboratory operating in conjunction with airborne instruments. The ground based investigations were performed at a number of locales representing a variety of terrains including open desert, cultivated fields, barren fields, portions of the San Andreas Fault Zone, and the Salton Sea. The measurements acquired ground truth data and microwave brightness data at wavelengths of 0.8 cm, 2.2 cm, and 21 cm. Author

N72-22369*# Kansas Univ., Lawrence. Dept. of Geography.

ENVIRONMENT MAPPING WITH SPACECRAFT PHOTOGRAPHY: A CENTRAL AUSTRALIAN EXAMPLE

David S. Simonett, G. Ross Cochrane, Stanley A. Morain , and Dwight E. Egbert Jun. 1969 51 p

(NASA Order W-12570; Contract DI-14-08-0001-10848)

(NASA-CR-126133; USGS-IR-NASA-172) Avail: NTIS CSCL 08B

Boundary delineation from space photographs as a precursor to area typing was studied for characterization of land use xor resource mapping near Alice Springs, Australia, where both boundary detection and categorization are complicated by the variations of the landscape. The detection and meaning of boundaries, and sources of confusion during categorization are discussed. F.O.S.

N72-22370*# Virginia Polytechnic Inst., Blacksburg. Research Div.

REMOTE SENSING IN VIRGINIA AGRICULTURE

D. E. Pettry, M. E. Newhouse, E. M. Dunton, Jr., and J. H. Scott, Jr. [1972] 7 p refs Original contains color illustrations

(Contract NAS6-1863)

(NASA-CR-62080; Rept-71) Avail: NTIS CSCL 02B

An experimental investigation, designed to develop and evaluate multispectral sensing techniques used in sensing agricultural crops, is described. Initial studies were designed to detect plant species and associated diseases, soil variations, and cultural practices under natural environment conditions. In addition, crop varieties, age, spacing, plant height, percentage of ground cover, and plant vigor are determined. Author

N72-22371# Kiruna Geophysical Observatory (Sweden).
KIRUNA GEOPHYSICAL DATA, APRIL - JUNE 1971 Data Summary
L. Liszka, (ed.) Jun. 1971 109 p Sponsored by ESRO
(KGO-Data-Summ-71/4-6) Avail: NTIS

A collection of results is presented for ground-based, continuous measurements of upper atmosphere variables carried out at Kiruna Geophysical Observatory and at the rocket range ESRANGE, Kiruna, Sweden. Current geophysical data is given, which is related to polar upper atmosphere conditions. The following upper atmosphere parameters were measured: geomagnetism, optical aurora, ionospheric ionization, radio wave propagation, and cosmic radiation. Author

N72-22372# Joint Publications Research Service, Arlington, Va.
OCEANOLOGY
11 Apr. 1972 38 p refs Transl. into ENGLISH from Okeanologiya (Moscow), v. 11, no. 5, 1971 p 773-801 and p 917-919
(JPRS-55676) Avail: NTIS

Topics of Soviet oceanographic research are presented, including a history of Soviet oceanology, the Soviet expeditionary fleet, marine physics, and work done by the Oceanographic Commission of the Soviet Academy of Sciences. K.P.D.

N72-22373# Finnish Meteorological Inst., Helsinki.
NUMERICALLY ANALYSED MAGNETIC CHARTS OF FINLAND FOR 1970
C. Sucksdorff, D. Soederman, and N. Gustafsson 1971 36 p refs
(Rept-22) Avail: NTIS

Magnetic charts of Finland for 1970 were prepared using some 400 three-component aeromagnetic survey points for the main area of Finland and more than 500 new land measurements for the eastern boundary area and the coast of the Gulf of Finland. A simple linear function was found to be sufficient for updating the data to 1970. For smoothing and drawing the charts, numercial analysis was used. Author

N72-22374*# National Aeronautics and Space Administration, Washington, D.C.
MEASUREMENT OF MOISTURE IN TYPICAL CHERNOZEM SOIL WITH AN AM-11 RESISTANCE SOIL MOISTURE METER
N. Slavov Apr. 1972 6 p refs Transl. into ENGLISH from Khidrol. Meteorol. (Sofia), v. 16, no. 5, 1967 p 67-69
(NASA-TT-F-14245) Avail: NTIS CSCL 08M

Laboratory and field tests of the AM-11 instrument in order to determine its suitability for operation in typical chernozem soil are reported. The AM-11 resistance moisture meter consists of a megohmeter and a set of transducers for soil moisture measurement to a depth of 100 centimeters. Maximum field moisture content for various soil types are presented. Author

N72-22375# Bonn Univ. (West Germany).
A ROCKET EXPERIMENT FOR THE DETERMINATION OF NEUTRAL GAS DENSITY AND COMPOSITION IN THE LOWER THERMOSPHERE WITH SPECIAL REGARD TO ATOMIC OXYGEN
D. Offermann, H. Trinks, K.-U. Grossmann, and H. Lorentz Jan. 1972 37 p refs In GERMAN; ENGLISH summary
(BMBW-FB-W-72-01) Avail: NTIS; ZLDI Munich: 8,20 DM

A rocket experiment with two neutral gas mass spectrometers and two photometers is described. The mass spectrometers were especially suitable to determine the thermospheric oxygen by the use of a cold-cathode ion source and a helium cooled ion source respectively. The photometers were intended to measure the atomic oxygen night glow emission at 5577 and 6300. The scientific instruments and some technical details of the payload as well as preparation of the experiment and the rocket flight are described. Some preliminary results of the mass spectrometer with the helium cooled ion source are presented. Author

N72-22376# Joint Publications Research Service, Arlington, Va.
SPACE METHODS FOR TERRESTRIAL STUDIES
B. V. Vinogradov and K. Ya. Kondratyev 18 Apr. 1972 238 p refs Transl. into ENGLISH of the book "Kosmich. Metody Zemlevedeniya" Leningrad, Gidrometeorol. Izd., 1971 792 p
(JPRS-55746) Avail: NTIS

Space methods of terrestrial studies are discussed in application to physics of the atmosphere, oceanography, hydrography, continental waters, soil and vegetation, geologic structure, and topography. An analysis is presented of television images and original photographs of the earth obtained from various space vehicles. An interpretation is given of local images which provide regional and global information on the natural environment. Author

N72-22377# European Space Research Organization, Paris (France).
THE ESRO GEOSTATIONARY MAGNETOSPHERIC SATELLITE
Mar. 1971 297 p refs Partly in ENGLISH and partly in FRENCH Proc. of an ESRO colloq. held at Lyngby, Denmark, 15-17 Oct. 1969
(ESRO-SP-60) Avail: NTIS

Scientific aspects of the ESRO geostationary magnetospheric satellite are considered, beginning with a review of the observations made in the vicinity of the synchronous orbit, followed by discussions on theoretical and experimental aspects of magnetic conjugacy; magnetospheric plasma phenomena; wave-particle interactions; studies of magnetospheric substorms, and coordination with ground-based observations and balloon-borne and rocket experiments. For individual titles, see N72-22378 through N72-22402.

N72-22378*# California Univ., La Jolla. Dept. of Applied Physics and Information Science.
A REVIEW OF FIELDS AND PARTICLE OBSERVATIONS MADE IN THE VICINITY OF THE SYNCHRONOUS ORBIT
W. I. Axford *In* ESRO The ESRO Geostationary Magnetospheric Satellite Mar. 1971 p 1-29 refs (See N72-22377 13-13)
(Grant NGR-05-009-075; Contract DA-31-124-ARO(D)-257)
(NASA-CR-126129) Avail: NTIS CSCL 03B

The observations made from the vicinity of the synchronous orbit are surveyed. The magnetic field, low-energy cosmic rays, energetic trapped particles, auroral and ring. Author (ESRO)

N72-22379# Denver Univ., Colo. Dept. of Physics.
MODELS OF MAGNETIC FIELD LINE GEOMETRY FOR A GEOSTATIONARY SATELLITE
F. D. Barish and J. G. Roederer *In* ESRO The ESRO Geostationary Magnetospheric Satellite Mar. 1971 p 31-48 refs Sponsored in part by Air Force Weapons Lab. (See N72-22377 13-13)
(Grant NSF GA-3905)
Avail: NTIS

A computer code for field line calculations was developed, which takes into account magnetic field contributions from external sources. A model magnetopause is assumed fixed in the solar-magnetospheric coordinate system and a model neutral sheet, oriented parallel to the ecliptic, is hooked onto the geomagnetic equator at given distance from the Earth in the midnight meridian. Computed conjugate intersects for geostationary satellite field lines reveal a diurnal and seasonal variation. The shape of the diurnal conjugate trace is in general elliptic (sometimes with a secondary loop), with one of the axes roughly perpendicular to the direction of the local magnetic declination. The amplitude of the diurnal excursion increases with magnetospheric compression. The latter, in addition, causes appreciable shifts of the diurnal-average position of the conjugate point. The conjugate trace also varies with season, usually being largest during the solstice. Author (ESRO)

N72-22380# Rome Univ. (Italy). Inst. of Physics.
EXPERIMENTAL RESULTS ON MAGNETIC CONJUGACY
F. Mariani *In* ESRO The ESRO Geostationary Magnetospheric Satellite Mar. 1971 p 49-68 refs (See N72-22377 13-13)
Avail: NTIS

The ground-based, balloon and satellite data obtained during recent conjugate point experiments are surveyed. Investigations using long-duration magnetic field variations and micropulsations, as well as particle precipitation, cosmic noise absorption, F region ionospheric events, VLF and other electromagnetic phenomena and optical observations, are reviewed. The benefits derived from geostationary satellite measurements, which permit analysis of temporal variations without the complications arising from spatial variations, are stressed. Author (ESRO)

N72-22381*# Rice Univ., Houston, Tex. Dept. of Space Science.
MAGNETOSPHERIC PLASMA PHENOMENA AT THE GEOSTATIONARY ORBIT c25
J. W. Freeman, Jr. and D. T. Young *In* ESRO The ESRO Geostationary Magnetospheric Satellite Mar. 1971 p 69-78 refs (See N72-22377 13-13)
(Contracts NSR-44-006-100; NAS5-9561)
(NASA-CR-126237) Avail: NTIS CSCL 03B

The principal phenomena detected by the low-energy plasma detector onboard the ATS-1 geostationary satellite are reviewed. They can be classed as:(1) directed flow of cool magnetospheric plasma,(2)magnetopause plasma flow;(3)plasma sheet dynamics; (4)hydromagnetic wave-induced plasma motion. The magnetosphere near the geostationary orbit is rich in phenomena accessible to a low-energy plasma detector on a spinning spacecraft. Author (ESRO)

N72-22382# European Space Research Inst., Frascati (Italy).
MACRO-INSTABILITIES IN THE MAGNETOSPHERE
K. Schindler *In* ESRO The ESRO Geostationary Magnetospheric Satellite Mar. 1971 p 79-90 refs (See N72-22377 13-13)
Avail: NTIS

The extent to which these instabilities can be detected at the geostationary orbit is discussed. It is found that the mirror, exchange, and tearing instabilities may play an important part, whereas the Kelvin-Helmholtz instability, if excited on the magnetopause, will probably not have a large effect at L = 6.6. Author (ESRO)

N72-22383*# TRW Systems Group, Redondo Beach, Calif. Space Sciences Lab.
COMPLEX ELECTRIC FIELD EMISSIONS OBSERVED BY OGO-5 ON 15 AUGUST 1968
C. F. Kennel, F. L. Scarf, F. V. Coroniti, R. W. Fredricks, and J. H. McGehee, Jr. *In* ESRO The ESRO Geostationary Magnetospheric Satellite Mar. 1971 p 91-100 refs (See N72-22377 13-13)
(Contract NAS5-9278; Grant NGR-05-007-190)
(NASA-CR-126238) Avail: NTIS CSCL 03B

OGO-5 results from the first broad-band electric field experiment to operate successfully beyond the plasmapause are presented, indicating that processes similar to those encountered in the laboratory may also operate in the magnetosphere. The wave electric and magnetic field data are discussed from a complex event observed on 15 August 1968, in which various types of electric field emissions above the electron cyclotron frequency, as well as electromagnetic chorus activity, occurred near the geomagnetic equator on auroral lines of force near local midnight. Details of the plasma wave detector and the dc and wave magnetic field diagnostics are also given. Author (ESRO)

N72-22384# Imperial Coll. of Science and Technology, London (England). Dept. of Physics.
LOW-FREQUENCY INTERACTIONS c24
D. J. Southwood *In* ESRO The ESRO Geostationary Magnetospheric Satellite Mar. 1971 p 101-106 refs (See N72-22377 13-13)
Avail: NTIS

General features of wave-particle interactions are reviewed for waves at frequencies much less than the proton gyro-frequency. A particular interaction which under certain conditions can result in amplification of an Alfven wave is emphasized. There is evidence that such an instability was observed on the ATS 1 geostationary satellite. Author (ESRO)

N72-22385# Imperial Coll. of Science and Technology, London (England). Dept. of Physics.
THE EFFECT OF RESONANT INTERACTIONS ON OBSERVED FLUX c24
J. W. Duncey and D. J. Southwood *In* ESRO The ESRO Geostationary Magnetospheric Satellite Mar. 1971 p 107-110 refs (See N72-22377 13-13)
Avail: NTIS

The linear effect of a wave on the observed flux of particles near resonance is discussed. Quantitive estimates of the sharpness of resonance and accompanying changes in observable parameters are calculated. Author (ESRO)

N72-22386# Imperial Coll. of Science and Technology, London (England). Dept. of Physics.
THE PLASMAPAUSE
J. O. Thomas *In* ESRO The ESRO Geostationary Magnetospheric Satellite Mar. 1971 p 111-118 refs (See N72-22377 13-13)
Avail: NTIS

As a preliminary step, the experimental techniques for in situ measurements of the plasmapause profile are assessed critically, and some of the difficulties encountered in low-density, thermal plasma diagnostics are outlined. Experiments based on electrostatic wave propagation are also evaluated. Author (ESRO)

N72-22387*# California Univ., Los Angeles. Dept. of Planetary and Space Science.
MAGNETIC FIELD VARIATIONS AT ATS 1
Robert L. McPherron and Paul J. Coleman, Jr. *In* ESRO The ESRO Geostationary Magnetospheric Satellite Mar. 1971 p 119-144 refs (See N72-22377 13-13)
(Grant NGR-05-007-004)
(NASA-CR-126240) Avail: NTIS CSCL 03B

Magnetic field variations observed with the magnetometer on the ATS 1 satellite are briefly described. These variations are classified according to whether they are macroscopic field changes or fluctuations and also whether they occur during quiet disturbed (substorms), or very disturbed (storms) times. It is concluded that a complete understanding of these complex, interrelated phenomena still requires study. Author (ESRO)

N72-22388# Southampton Univ. (England). Dept. of Physics.
GEOSTATIONARY SATELLITE STUDIES OF MAGNETOSPHERIC SUBSTORMS
P. Rothwell *In* ESRO The ESRO Geostationary Magnetospheric Satellite Mar. 1971 p 145-148 refs (See N72-22377 13-13)
Avail: NTIS

In addition to geostationary satellite experiments for substorm investigations, other simultaneous experiments in the ionosphere, magnetosphere, and nearby interplanetary space are considered. Magnetospheric electric fields, electron acceleration mechanisms in the magnetosphere and plasma sheet, wave-particle interactions during substorms, and the origin of the magnetospheric plasma are discussed, and the rapid dissemination of some geostationary satellite data is proposed. Author (ESRO)

N72-22389# Kiruna Geophysical Observatory (Sweden).
RESULTS FROM THE ESRO 1 LOW-ENERGY PARTICLE EXPERIMENT AND THEIR RELATION TO A GEOSTATIONARY SATELLITE PROJECT

R. Riedler (Tech. Hocheschule in Graz) *In* ESRO The ESRO Geostationary Magnetospheric Satellite Mar. 1971 p 149-154 refs (See N72-22377 13-13)
Avail: NTIS

The results from the S.71B low-energy particle spectra experiment on board the ESRO 1 satellite are discussed, and conclusions are drawn concerning the possibility of mounting a similar experiment on a geostationary satellite. Author (ESRO)

N72-22390# Kiruna Geophysical Observatory (Sweden).
MAGNETOSPHERIC SUBSTORMS: GEOSTATIONARY SATELLITE INVESTIGATIONS IN RELATION TO GROUND-BASED OBSERVATIONS
Bengt Hultqvist *In* ESRO The ESRO Geostationary Magnetospheric Satellite Mar. 1971 p 155-158 (See N72-22377 13-13)
Avail: NTIS

It is suggested that because satellite particle measurements relate to a smaller volume of space they should have higher priority over magnetic and electric field measurements. The need for ground-based substorm measurements from N. Scandinavia, Spitzbergen, Bear Island, Iceland, Greenland, Jan Mayen, as well as from Soviet and N. American sites is stressed. Data processing requirements are also discussed. Author (ESRO)

N72-22391*# Toulouse Univ. (France). Centre d'Etude Spatiale des Rayonnements.
PERIODIC VARIATIONS OF ELECTRON FLUXES OBSERVED AT SYNCHRONOUS ALTITUDES
George K. Parks *In* ESRO The ESRO Geostationary Magnetospheric Satellite Mar. 1971 p 163-174 refs (See N72-22377 13-13)
(Contract NAS5-9542; Grant NSF GA-487)
(NASA-CR-126239) Avail: NTIS CSCL 03B

Temporal analysis of electron fluxes detected at synchronous altitudes indicates that the commonly observed periodic variations in the precipitated fluxes also persist in the equatorial electrons with large pitch-angles. The dynamic spectral analysis of twenty consecutive days of electron data indicates that the substorm-correlated increases of electrons observed in the equatorial plane have a recurrence period of about 2.5 hours. Faster fluctuations are also observed within the substorm period. These include variations of a few minutes period and the more rapid 5 to 40-second periods. Author (ESRO)

N72-22392# Bergen Univ. (Norway). Dept. of Physics.
COORDINATED STUDIES OF PRECIPITATED ELECTRONS BY GEOSTATIONARY SATELLITE AND BALLOONS
Harald Trefall *In* ESRO The ESRO Geostationary Magnetospheric Satellite Mar. 1971 p 175-177 (See N72-22377 13-13)
Avail: NTIS

Examples of the local time variations of the spatial character of electron precipitation events over northern Scandinavia are discussed. Conjugate points may move around by several hundred kilometres a day and useful simultaneous balloon and satellite measurements are only likely when the conjugate point is within about 100 km of the balloon. Balloon launchings from a north-south chain of stations across the auroral zone to determine the latitude, and possibly the longitude, of the point conjugate to the satellite are proposed. Improved balloon and satellite instruments are also proposed.
Author (ESRO)

N72-22393# Norwegian Defence Research Establishment, Kjeller.
THE GEOSTATIONARY SATELLITE AS A DETECTOR OF ULTRAVIOLET SUNRISE AND SUNSET c14
R. J. Armstrong *In* ESRO The ESRO Geostationary Magnetospheric Satellite Mar. 1971 p 181-182 ref (See N72-22377 13-13)
Avail: NTIS

A proposal for using a geostationary satellite for observing ultraviolet sunrise and sunset is presented for determination of zone profiles. The instrument would detect macroscopic changes in ozone absorption and ozone content. Author (ESRO)

N72-22394# Technical Univ. of Denmark, Lyngby. Ionosphere Lab.
CHARGED PARTICLE EMISSION FROM A GEOSTATIONARY SATELLITE c25
Peter Stauning *In* ESRO The ESRO Geostationary Magnetospheric Satellite Mar. 1971 p 183-199 refs (See N72-22377 13-13)
Avail: NTIS

A quantitative model is derived for the interaction of a satellite emitting charged particles with an ionized medium characterized by satellite radius less than Debye length less than electron gyro radius. In a numerical evaluation of the I-V characteristic for the idealized representation of a geostationary satellite, realistic values for the outer magnetosphere plasma densities, temperature, and magnetic fields were used. It is shown that the emission of small currents of energetic particles can cause changes in the satellite equilibrium potential. Changes of several hundred volts are found for electron or ion currents of about 1 mA. It is suggested that such a capability should be included in the payload of the ESRO geostationary satellite to optimize the operational conditions for plasma and electric field experiments and, together with these experiments, to investigate plasma parameters, resonance, and instabilities and to study the precise interaction of a spacecraft with a dilute, ionized medium.
Author (ESRO)

N72-22395# Centre National d'Etudes des Telecommunications, Issy-les-Moulineaux (France).
AN ACTIVE RADIOWAVE EMISSION EXPERIMENT c07
M. Petit *In* ESRO The ESRO Geostationary Magnetospheric Satellite Mar. 1971 p 201-212 refs (See N72-22377 13-13)
Avail: NTIS

Active radiowave emission experiments are proposed for the four frequency ranges, (1) 50 MHz (Faraday effect), (2) 100 kHz (topside plasmapause observations), (3) 3-10 kHz (resonance studies), and (4) 1-3 kHz (low-frequency wave emissions, including artificially stimulated waves). Author (ESRO)

N72-22396# Sussex Univ., Brighton (England). Plasma Physics Group.
PRELIMINARY PROPOSAL FOR EXPERIMENTS ON THE ESRO GEOSTATIONARY SATELLITE (GEOS) c25
G. Martelli and J. Troughton *In* ESRO The ESRO Geostationary Magnetospheric Satellite Mar. 1971 p 213-222 refs (See N72-22377 13-13)
Avail: NTIS

Proposed geostationary satellite experiments concerning (1) the magnetospheric knee, (2) plasma resonances, and (3) plasma wave noise are discussed. Author (ESRO)

N72-22397# European Space Research and Technology Center, Noordwijk (Netherlands). Satellites and Sounding Rockets Dept.
THE GEOSTATIONARY SATELLITE TELEMETRY SYSTEM c07
W. Lothaller *In* ESRO The ESRO Geostationary Magnetospheric Satellite Mar. 1971 p 223-229 (See N72-22377 13-13)
Avail: NTIS

The telemetry system of the geostationary satellite as proposed in the ESRO feasibility study, is briefly discussed, and the subsystem layout and its capabilities are presented. The choice of microwave telemetry is justified in terms of the essential parameters of the telemetry link power budget. Possible ways of increasing the telemetry bit rate capacity without changing the present satellite concept are suggested. Modifications giving higher information transfer capabilities which would have an impact on the satellite concept and/or on the project cost, are also discussed. Author (ESRO)

N72-22398# Centre National d'Etudes des Telecommunications, Issy-les-Moulineaux (France).
THE SCIENTIFIC VALUE OF COMPUTING FACILITIES FOR ESRO SATELLITE MISSIONS c08
F. DuCastel *In* ESRO The ESRO Geostationary Magnetospheric Satellite Mar. 1971 p 231-236 refs (See N72-22377 13-13)
Avail: NTIS

The ways in which a stored, instead of a wired, program could increase the scientific significance of an experiment are considered and applied to proposed geostationary satellite experiments. If the data analysis can be made onboard, particularly with a revisable stored program, then the characteristics of the sensors can be continuously adjusted to the actual phenomenon. The following successive steps need to be taken before introducing computers onboard a satellite: (1) a precise study of the scientific requirements, entailing a good comprehension of the physical processes, (2) a study of the relevant problems of logic, (3) a feasibility study of the onboard computer itself and of the consequences of its inclusion in the satellite, and (4) a related study of the required transmission capacities between the earth stations and the satellite.
Author (ESRO)

N72-22399# Centre National d'Etudes Spatiales, Bretigny-sur-Orge (France). Div. de Techniques Electroniques et Traitement de l'Information.
ONBOARD COMPUTERS, SOME TECHNICAL CONSIDERATIONS [CALCULATEURS EMBARQUES, QUELQUES CONSIDERATIONS TECHNIQUES] c08
J. Cazemajou *In* ESRO The ESRO Geostationary Magnetospheric Satellite Mar. 1971 p 237-248 refs In FRENCH (See N72-22377 13-13)
Avail: NTIS

After briefly reviewing the structure and function of computers, the importance of the role which certain parameters play in onboard computers is discussed. The parameters (weight and reliability) each determine solutions which could be adapted for the principal subsystems. A comparative table of several onboard computers in service is also given. Author (ESRO)

N72-22400# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
PROBLEMS OF DC ELECTRIC FIELD MEASUREMENTS FROM A GEOSTATIONARY SATELLITE c25
U. Fahleson *In* ESRO The ESRO Geostationary Magnetospheric Satellite Mar. 1971 p 249-265 refs (See N72-22377 13-13)
Avail: NTIS

The design and operation of an electric field detector of the double probe type on a geostationary satellite is discussed. Major difficulties are expected, due to electric-field distortion and photoelectrons from the satellite, and also to photoemissivity variations on the probe surfaces. Precautions to keep errors arising from these and other effects at a harmless level are investigated. Author (ESRO)

N72-22401# Groupe de Recherches Ionospheriques, Paris (France).
ELECTRIC FIELD EXPERIMENTS: ALTERNATING FIELDS c25
L. R. O. Story *In* ESRO The ESRO Geostationary Magnetospheric Satellite Mar. 1971 p 267-279 refs (See N72-22377 13-13)
Avail: NTIS

The characteristic frequencies of the ambient plasma and the properties of the electromagnetic and electrostatic waves propagating through it are described. The difficulties of using three different kinds of antenna are listed. The joint problems of field measurement and interpretation for simple plane waves as well as complex random wave fields are discussed for both electromagnetic and electrostatic waves, and recommendations for future theoretical and experimental studies are made.
Author (ESRO)

N72-22402# Consiglio Nazionale delle Ricerche, Rome (Italy). Ist. Nazionale di Ricerche Spaziali.
PLANS FOR AN ITALIAN GEOSTATIONARY SATELLITE c30
B. Ratti *In* ESRO The ESRO Geostationary Magnetospheric Satellite Mar. 1971 p 281-284 (See N72-22377 13-13)
Avail: NTIS

Preliminary details of SIRIO, the Italian geostationary satellite project are given. The super high-frequency, trapped radiation, and high-energy electron experiments are described.
Author (ESRO)

N72-22403# Comitato Nazionale per l'Energia Nucleare, La Spezia (Italy). Laboratorio per lo Studio della Contaminazione Radioattiva del Mare
STUDIES IN THE RADIOACTIVE CONTAMINATION OF THE SEA Annual Report, 1970
M. Bernhard 1971 84 p refs
(EUR-4701-e; RT/BIO-(71)4) Avail: AEC Depository Libraries; EUR FF 13.80

The Seventh Annual Report of the CNEN-Euratom Contract of Association is presented. The program laid down calls for studies of the factors that influence the distribution of radioisotopes and stable isotopes in the marine environment. The program is divided into two parts: relevant environmental factors in the Ligurian Sea and in the Gulf of Taranto, where the Italian fuel processing plant will be constructed; and the influence of environmental factors on the uptake, accumulation, and loss of radioisotopes by components of the marine environment. The task of carrying out this program was divided between five groups: chemistry, botany, zooplankton, microbiology, and special developments. An account is given of the results obtained by these groups in 1970. Author (NSA)

N72-22404# Blume (John A.) and Associates Research Div., San Francisco, Calif.
SPECTRAL MATRIX METHOD OF PREDICTING DAMAGE FROM GROUND MOTION
John A. Blume and Robert E. Monroe Sep. 1971 90 p refs
(Contract AT(26-1)-99)
(JAB-99-81; UC-35) Avail: NTIS

Many factors influence structure damage caused by ground motion generated by underground nuclear detonations or earthquakes; such factors include the number and type of structures exposed, the level of ground motion, and the capacity of structures to resist the motion. On a large scale it is necessary to express the variables statistically and to predict damage levels based upon the joint statistical distribution of the individual variables. The spectral matrix method (SMM) was devised to incorporate all relevant parameters in a unified prediction scheme which takes into account statistical variations of the individual factors. A discussion is presented of the SMM and its application in relation to past and current programs of the U. S. Atomic Energy Commission, Nevada Operations Office.
Author (NSA)

N72-22405# Environmental Research Corp., Las Vegas, Nev.
OBSERVED GROUND MOTION DATA, CANNIKIN EVENT
Lewis R. West and Raymond K. Christie Dec. 1971 30 p refs
(Contract AT(29-2)-1163)
(NVO-1163-230) Avail: NTIS

The results of the processing of the observed ground motion from the Cannikin event, an underground nuclear detonation on Amchitka Island are presented. Ground motion data recorded at instrument stations were processed and compiled. Pseudo-relative velocity spectra at 5% damping were derived from the velocity seismograms. Author (NSA)

N72-22406# Environmental Research Corp., Las Vegas, Nev.
REVIEW OF THE GROUND MOTION PREDICTION PROBLEM FOR PLOWSHARE UNDERGROUND ENGINEERING APPLICATIONS

Walter W. Hays 1971 20 p refs Presented at the joint meeting of the Am. Nucl. Soc., Miami, 17-21 Oct. 1971
(Conf-711009-10) Avail: NTIS

Ground motion prediction methodology incorporates both empirical and theoretical analyses and was developed in terms of the three critical elements of the total wave propagation systems: the source region; the transmission path; and the recording site geology. Over 3,000 seismograms were analyzed. Statistical analyses addressed the behavior of peak amplitudes of particles acceleration, displacement, and velocity; response spectra; and wave forms (all as a function of energy release at the source, the source-to-recording site distance, and the local site geology). Mathematical models were developed which give quantitative predictions of the effects of the source, transmission path, and site geology, in terms of measurable physical parameters. Author (NSA)

N72-22407# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
STRAIN MEASUREMENTS IN THE ALEUTIAN ISLANDS
Don Tocher, John H. Pfluke, and M. E. Blackford Oct. 1971 27 p refs
(NVO-464-1) Avail: SOD $0.35

The equipment and methods are described, which were used in carrying out the Aleutian Island strain measurement program begun in 1969 for monitoring and interpreting the state of near-surface earth strains and tilts. Information is given on the tectonics of the Aleutian Islands, location and type instruments used in the monitoring network, data obtained to mid-October 1970, and data analysis. NSA

N72-22408# Geological Survey, Denver, Colo.
MARINE GEOPHYSICAL STUDY AROUND AMCHITKA ISLAND, WESTERN ALEUTIAN ISLANDS, ALASKA
Roland VonHuene, W. J. Carr, Dean McManus, and Mark Holmes 1971 35 p refs
(Contract AT(29-2)-474)
(USGS-474-74; Amchitka-22) Avail: NTIS

Marine geophysical surveys made around Amchitka in 1969 included fathometer, seismic reflections, and magnetic recording along ship's tracks totaling more than 1,200 km. Stratigraphy and structure of the Amchitka Island area can be extrapolated in a general way to help explain and interpret the marine seismic and magnetic records and submarine topography. Differences in submarine geomorphology around Amchitka reflect basic structural elements related to development of the island arc. The seismic records around Amchitka indicate a general scarcity of highly reflective layers in the bedrock. In a few areas on the insular shelf and upper slopes very thin sediments are present, commonly adjacent to fault scarps; in a few such areas these relatively young sediments appear to have been slightly displaced or tilted by faulting. Thicker sediments are present, however, in the deep valleys and basins north and east of Amchitka.
Author (NSA)

N72-22409# Istituto di Fisica Dell Atmosfera, Rome (Italy).
MATHEMATICAL MODEL OF THE ADRIATIC SEA FOR THE STUDY AND PREVISION OF THE HIGH WATERS IN VENICE [UN MODELLO NUMERICO DEL MARE ADRIATICO PER LO STUDIO E LA PREVISIONE DELL'ACQUA ALTA A VENEZIA]
C. Finizio, S. Palmieri, and A. Riccucci Apr. 1970 79 p refs In ITALIAN Prepared jointly with Aeron. Militare Ital.
(IFA-STR-14) Avail: NTIS

A unidimensional (SW-NE) model of the Adriatic Sea was set up considering the gradient force, the wind surface stress, and the sea bottom friction in the hydrodynamic equilibrium equation. Two fundamental periods (29 h and 11.5 h) depending on the dimensions of the sea bed were determined, after the integration of the transport equation. The model was applied to explain six cases of considerable elevation of the sea level in the Venetian Laguna. Between calculated and measured magnitudes a mean squared deviation of 13 cm was found for the sea levels and mean absolute difference of two hours between theoretical and actual occurrence of level maxima. Author (ESRO)

N72-22410# Royal Aircraft Establishment, Farnborough (England).
UPPER ATMOSPHERE HEATING AT HIGH LATITUDES
R. R. Allan Aug. 1971 17 p refs Presented at the 14th COSPAR Symp., Seattle, Jun. 1971
(RAE-TR-71167; BR-26753) Avail: NTIS

The orbit of Molniya 1K (1968-85A) from November 1968 to November 1970 was analyzed to study variations in air density near 65 deg S The air density is sampled over very short arcs because of the high eccentricity (0.74), and the sampling is confined to two small regions of the earth since the orbit is 2:1 commensurable with the earth's rotation. The air density at 400 km shows great variability, apparently not related to the geomagnetic index Kp, with maxima which exceed the corresponding values at the equator by a factor of at least 6; the highest densities occur near 18 h local time. Author (ESRO)

N72-22411# Saab Aircraft Co., Linkoping (Sweden). Missile and Electronics Div.
MICROWAVE RADIOMETRY AND ITS POTENTIAL APPLICATION TO EARTH RESOURCES SURVEYS: PHYSICAL BACKGROUND AND TECHNOLOGICAL IMPLEMENTATION
Sune Axelsson and Olov Edvardsson Oct. 1971 106 p refs
(Contract ESTEC-1411/71-EL)
(ESRO-CR(P)-71; RAC-0-3-R15) Avail: NTIS

The physical principles of microwave radiometry are presented, and its application to satellite earth resources observation is discussed. The remote sensing of objects with temperature above absolute zero is limited by several factors, such as atmospheric attenuation, and interference from other radiation sources. This limits the choice of the observation frequency. Further error sources are output noise and limited resolution. A general survey is given of radiometer design, antenna types, and receivers. Displays are mentioned, and the characteristics of existing radiometers are given. ESRO

N72-22412# Kiruna Geophysical Observatory (Sweden).
KIRUNA GEOPHYSICAL DATA: DATA SUMMARY 71/1-3, JANUARY - MARCH 1971
L. Liszka, ed. 1971 164 p Prepared Jointly with Europ. Space Sounding Rocket Range
Avail: NTIS

Results of ground-based measurements of upper atmosphere variables made at Kiruna, Sweden, are listed for January to March 1971. Recorded data include K indices, magnetic pulsations, standard magnetograms, and ionospheric absorption. ESRO

N72-22413# Academy of Sciences (USSR), Moscow. Inst. for Space Research.
ON EARTH MAGNETIC TAIL OSCILLATIONS IN QUASI-HYDRODYNAMICS APPROXIMATION
A. I. Ershkovich and S. A. Martjanov 1971 18 p refs
(PR-82) Avail: NTIS

On the basis of Chew-Goldberger-Low quasi-hydrodynamic equations the earth magnetic tail oscillations are considered in the model of a plasma cylinder with a free boundary. A dispersional equation of oscillations is obtained and its approximate solution is compared with the results obtained using the monoliquid magnetic hydrodynamics of ideal conductivity equations. It is shown that the long-periodic variations of the magnetic field may manifest themselves as eigenmodes of the earth magnetic tail. Author (ESRO)

N72-22414# Academy of Sciences (USSR), Moscow. Inst. for Space Research.
INVESTIGATION OF THREE-DIMENSIONAL CURRENT

SYSTEMS
L. L. Vanyan, A. S. Debabov, and I. L. Osipova 1971 15 p refs
(D-94) Avail: NTIS

Two models of magnetospheric electric field aligned currents were investigated to explain the auroral electrojet nature. The first model had downward and upward currents separated along the longtitude (east-west magnetospheric electric field). The second model was based on a two sheet current system (north-south electric field). It is shown that morning and evening magnetospheric currents of disturbed regions have the most effect on auroral jet production; transverse magnetic disturbances at 1000 km altitude are mainly caused by the two-sheet current system, but the contribution of these currents to the electrojet is rather small; the main part of the field-aligned current flows through the electrojet and the remaining current through undisturbed ionosphere. ESRO

N72-22415# Naval Scientific and Technical Information Centre, Orpington (England).
SOME CHARACTERISTICS OF WIND WAVES IN THE DEEP AND SHALLOW WATERS OF A BAY
V. A. Rutkovskii Sep. 1971 16 p refs Transl. into ENGLISH from Okeanologiya (Moscow), v. 11, issue 1, 1971
(AD-734511; NSTIC-Trans-2508; TRC-BR-27450) Avail: NTIS CSCL 08/3

The results of measuring the elements of wind waves and the wave pressure caused by them at sub-surface levels in both the deep and shallow waters of a bay are examined. The experimental distribution of wave heights and periods is compared with the generalized distribution function. The transformation of the wind wave spectrum with depth and in the passing of waves from deep to shallow water is analyzed. Author (GRA)

N72-22416# Bergen Univ. (Norway). Seismological Observatory.
EXPERIMENTS WITH CHIRP FILTERING OF SURFACE WAVES Interim Report
Leif Bruland and Eivind Rygg 30 Jun. 1971 41 p refs
(Contract F61052-68-C-0019; ARPA Order 292)
(AD-735725; SR-6; AFOSR-72-0159TR; SR-6) Avail: NTIS CSCL 08/11

In connection with the application of linear chirp filters to dispersed surface wave trains recorded at LASA, Montana, a number of events from the SinoSoviet region have been examined in order to determine the predictability of the time of the maximum filter output. The group velocities thus obtained were compared with the group velocities determined by an analyst using ordinary dispersion analysis. On the basis of the scatter in group velocities found, 'arrival time windows' for surface waves from various regions are given. Dispersion analysis has shown that the assumption of a linear frequency variation in surface waves is not always satisfactory. Therefore, we have allowed for non-linear frequency variation in the chirp filters, and some applications of such filters are demonstrated.
Author (GRA)

N72-22417# Aeronautical Chart and Information Center, St. Louis, Mo.
ONE DEGREE BY ONE DEGREE MEAN FREE-AIR GRAVITY ANOMALIES
Charles A. Lechner, John J. Gillespie, and George Larry, Jr. Aug. 1971 264 p
(AD-735268; ACIC-Ref-Pub-29) Avail: NTIS CSCL 08/5

The publication contains a set of 1 degree x 1 degree mean free-air anomaly (MFAA) values for portions of the world where sufficient gravity data is available for anomaly computation. The values are referred to the International Ellipsoid and represent the mean values of anomalous gravity within a surface area one degree in latitude by one degree in longitude. Whenever possible, the MFAA values were developed directly from observed gravity data. Mean anomaly values in ocean areas were computed from point free-air anomalies, and mean anomaly values over land areas were computed using point Bouguer anomalies plus 1 degree x 1 degree mean elevations. In some areas of sparse or no observed gravity coverage, the mean anomalies were determined using gravity-geophysical correlation prediction techniques. MFAA Standard errors were determined as a function of the density, distribution, and accuracy of the observed gravity data. The available 1 degree x 1 degree MFAA values and standard errors are listed in milligals, in tabular form, on facing pages. Each page of the data table represents an area of 20 degrees in latitude by 20 degrees in longitude, with page 1 commencing at 90 degrees N and 0 degrees E. Author (GRA)

N72-22418# Alaska Univ., College. Inst. of Marine Science.
CARBON DIOXIDE AND PRIMARY PRODUCTIVITY IN THE GLACIAL FIORD SYSTEM OF SOUTHEASTERN ALASKA
Linda L. Longerich, Margaret M. Billington, Vera A. Alexander, John J. Kelley, and D. W. Hood Sep. 1971 23 p refs
(Contract N00014-67-A-0317-0001)
(AD-734672; R71-19) Avail: NTIS CSCL 08/10

The equilibrium concentration of CO2 in surface sea waters has been recently measured for the North Pacific Ocean, the coastal waters near the Aleutian Island chain, the Alaska Peninsula, and southcentral Alaska. Of the many varied Alaskan coastal areas investigated, one notable omission has been the glacial fiord area of Southeastern Alaska. Thus early spring studies of carbon dioxide concentrations and primary productivity were made in this glacial fiord system. It was found that the surface waters of Auke Bay at the beginning of the spring bloom had a lower CO2 concentration and higher particulate nitrogen and 14C-HCO3 uptake than the more open waters surrounding it. Surface water CO2 in a glacial outflow area was unexpectedly low compared to values for surface seawater in a normal fresh water stream outflow. An example of wind induced upwelling was noted. Author (GRA)

N72-22419# Alaska Univ., College. Inst. of Marine Science.
CARBON DIOXIDE IN THE SURFACE WATERS OF THE BARENTS SEA: SOUTHWIND EXPEDITION, 1970
John J. Kelley and D. W. Hood Sep. 1971 17 p refs
(Contract N00014-67-A-0317-0001)
(AD-734673; R71-20) Avail: NTIS CSCL 08/10

The report presents the results of measurements of the equilibrium concentration of carbon dioxide with respect to air in the surface waters of the Barents Sea during the late summer 1970 aboard the U.S. Coast Guard Icebreaker SOUTHWIND. This investigation was undertaken to gain information on the magnitude of carbon dioxide partial pressures in the region of arctic summer sea ice pack. Author (GRA)

N72-22420# Naval Undersea Research and Development Center, San Diego, Calif. Ocean Sciences Dept.
DETECTING SUDDEN CHANGES IN TIME SEQUENCES WITH APPLICATION TO OCEAN TEMPERATURES Report for Jun. 1966 - Aug. 1968
Robert H. Riffenburgh Nov. 1971 34 p refs
(AD-734389; NUC-TP-263) Avail: NTIS CSCL 08/10

Two years of irregularly spaced measurements of seawater temperature at 200 ft at a fixed North Pacific Ocean location are considered. The data show changing variances in time, and the average path jumps about erratically. Author (GRA)

N72-22421# Army Foreign Science and Technology Center, Charlottesville, Va.
BASIC METHODS OF TECHNOLOGICAL PROGRESS IN TOPOGRAPHIC-GEODETIC AND CARTOGRAPHIC AFFAIRS
L. A. Kashin 7 Oct. 1971 15 p Transl. into ENGLISH from Geod. Kartograficheskom (USSR), no. 3, 1969
(AD-736001; FSTC-HT-23-801-71) Avail: NTIS CSCL 08/2

The history of technical progress on various levels of topography, geodesy, and cartography in the USSR is traced and its future mapped. Author (GRA)

N72-22422# Naval Postgraduate School, Monterey, Calif.
DYNAMIC ANALYSIS OF THE NAVAL POSTGRADUATE SCHOOL OCEAN INSTRUMENT PLATFORM M.S. Thesis
Mark Francis Crane Sep. 1971 78 p refs
(AD-736117) Avail: NTIS CSCL 13/10

The dynamic and static response of the proposed NPS ocean instrument platform is investigated by developing and solving linear differential equations of motion of the tower in surge, heave, and pitch. The motion is expressed as a response spectrum which is directly proportional to a wave spectrum as the exciting force. The analysis made for various configurations of the lateral restraining cables using both a five point and nine point mooring system. Author (GRA)

N72-22423# George Washington Univ., Washington, D.C.
RELATIVE GENERATION OF SEISMIC WAVES TO 4,000 KILOMETERS EPICENTRAL DISTANCE Final Report, 1 Nov. 1970 - 31 Dec. 1971
J. W. Pierce and S. A. Alsup 31 Dec. 1971 66 p refs
(Grant AF-AFOSR-1985-71; ARPA Order 1705)
(AD-736526; AFOSR-72-0273TR) Avail: NTIS CSCL 17/10

Lateral variations of seismic wave absorption in the upper mantle beneath the United States are determined by calculation of seismic Q for Pn wave paths. Departures from the amplitude decay of the Pn wave predicted by cylindrical spreading along the crust-mantle boundary form the basis of the Q estimation. Agreement between the contours of upper mantle Q and other geophysical parameters is also demonstrated in some detail, particularly with teleseismic signal amplitude variations and delay time, heat flow, and the anamolous field intensities induced by geomagnetic storms. Author (GRA)

N72-22424# Aerospace Corp., El Segundo, Calif.
STRONG PITCH ANGLE SCATTERING OF ENERGETIC ELECTRONS IN THE PRESENCE OF ELECTROSTATIC WAVES ABOVE THE IONOSPHERIC TROUGH REGION Technical Report, Jan. - Jun. 1971
Harry C. Koons, Donald A. McPherson, and Alfred L. Vampola Nov. 1971 19 p refs
(Contract F04701-71-C-0172)
(AD-736432; TR-0172(9220-01)-2; SAMSO-TR-71-325) Avail: NTIS CSCL 04/1

Simultaneous measurements of energetic electrons and electrostatic waves in the midlatitude trough region indicate that events characterized by strong pitch-angle diffusion in the altitude range 2000 to 4500 km occur in the presence of ELF electrostatic waves. These waves are attributed to a current-driven ion cyclotron instability. Scattering by electrostatic waves is sufficient to account for the strong pitch-angle scattering commonly observed by low-altitude satellites and for the sharply defined feature previously referred to as the outer trapping boundary. Author (GRA)

N72-22425# International Business Machines Corp., Burlington, Mass. Advanced Systems Design Dept.
ATMOSPHERIC MODEL EVALUATION Final Report, Jan. 1970 - Sep 1971
Arnold S. Bramson and Jack W. Slowey Nov. 1971 63 p refs
(Contract F19628-70-C0085; AF Proj. 8605; AF Proj. 6690)
(AD-736443; AFCRL-71-0543) Avail: NTIS CSCL 04/1

The report documents a computer program which has been developed for testing and evaluating atmospheric models. The present version of the program contains ten such models which have been evaluated using a variety of satellite orbits as test data. An important feature of the program is an ephemeris generator which requires considerably less computer time than a standard numerical integration technique. This procedure is documented in Appendix B. Complete instructions for running the program are given in Appendix A, and a description of the ten atmospheric models presently contained in the program may be found in Appendix C. Author (GRA)

N72-22426# Naval Postgraduate School, Monterey, Calif.
THE WORLD OCEAN: INTERNATIONAL PROBLEMS AND AMERICA'S CHOICES M.S. Thesis
Gary Warren Wilson Sep. 1971 115 p refs
(AD-735311) Avail: NTIS CSCL 05/4

Under pressure of more intensive and diverse uses, the legal principle of Freedom of Access to marine resources is no longer sufficient to regulate man's activities in the marine environment. An analysis of the factors which must be considered in designing a workable regime for the future exploitation of the ocean was conducted. Oceanographic as well as political and economic factors are examined, and alternative solutions evaluated as to their ability to satisfy various interests and objective considerations. A recommended formula for the delimitation of coastal state jurisdiction in ocean space and a proposed structure for an International Ocean Authority to regulate activities in the area beyond national jurisdiction are advanced. GRA

N72-22427# Naval Civil Engineering Lab., Port Hueneme, Calif.
DEEP OCEAN TEST-IN-PLACE AND OBSERVATION SYSTEM (DOTIPOS) FOR NAVAL SEAFLOOR CONSTRUCTION SUPPORT Technical Report, Nov. 1965 - Jan. 1971
J. R. Padilla Dec. 1971 36 p refs
(YF38535002)
(AD-736597; NCEL-TR-752) Avail: NTIS CSCL 13/10

The Deep Ocean Test-In-Place and Observation System (DOTIPOS), is a pyramid-shaped aluminum platform for deploying systems on the ocean floor, data collection, and in-situ testing. It weights 6,200 pounds in air, 2,000 pounds in the water and is supported by three square pads. Bolted construction permits disassembly for shipping, the longest section being fifteen feet four inches long. Permanent equipment mounted on the platform includes a pressure-equalized, steel-cased, 20 kva transformer (2400/115 volts AC, single phase, 60 Hz). A 24-inch OD aluminum sphere houses the control and data electronics. Stainless steel camera housings have acrylic windows in one end and a 250-watt mercury vapor light attached to the sides. Author (GRA)

N72-22428# Washington Univ., Seattle.
GREENLAND SEA CURRENTS
Knut Aagaard 30 Dec. 1971 10 p refs
(Contract N00014-67-A-0103-0023; ARPA Order 1783)
(AD-735519) Avail: NTIS CSCL 08/3

The document concerns the direct current measurement of ocean currents in the Greenland Sea. The methods and equipment used in this project are described in the report. GRA

N72-22429# California Univ., La Jolla. Inst. of Geophysics and Planetary Physics.
LOW FREQUENCY DISCRIMINANTS Final Report
Barry Block, James N. Brune, Jay Dratler, Jr., William E. Farrell, and Gilbert Freeman 28 Sep. 1971 41 p refs
(Contract F44620-70-C-0099; ARPA Order 1618)
(AD-735179; AFOSR-72-0082TR) Avail: NTIS CSCL 08/11

Contents: Surface Wave Detection with a Broad Band Accelerometer; High-Q Overtone Modes of the Earth; Report on a New Broad Band Vertical Accelerometer; Teleseismic Detection with Wide Band Vertical and Horizontal Accelerometers. GRA

N72-22430# Teledyne Geotechnical, Alexandria, Va. Seismic Data Lab.
[SEISMIC RESEARCH ON DETECTION AND IDENTIFICATION OF NUCLEAR EXPLOSIONS AND EARTHQUAKES] Quarterly Technical Summary Report, Oct. - Dec. 1971
Royal A. Hartenberger 15 Jan. 1972 10 p
(ARPA Order 1714; AFAC Proj. VELA-T/2706)
(AD-736253) Avail: NTIS CSCL 17/10

The report summarizes the work done by the SDL during the period October through December 1971, and primarily concerns the seismic research activities related to the detection and identification of nuclear explosions and earthquakes. The

report also contains brief discussions of the support tasks and data services which were performed for other government contractors and for participants in the VELA-UNIFORM and PRIME ARGUS projects. Author (GRA)

N72-22431# Naval Underwater Systems Center, Newport, R.I.
PROJECT CANUS: SOUND PROPAGATION AND REVERBERATION MEASUREMENT IN HUDSON BAY
David G. Browning 1 Dec. 1971 40 p refs
(SF 11552008)
(AD-736155; NUSC-4221) Avail: NTIS CSCL 08/10

An experiment was conducted in Hudson Bay during August 1970 to obtain propagation and reverberation data below 12kHz. A listening hydrophone was suspended from an Amphibian stationed 90 miles east of Cape Churchill. Explosive charges were dropped from an aircraft along a 270-mile track to Coats Island. Additional charges were detonated close to the hydrophone to obtain the reverberation data. BT information from along the propagation track indicated a sound channel with an axial depth of 80 feet over a flat hard bottom at an average depth of 425 feet. Propagation loss curves were obtained for 1/3-octave bands from 300 to 5000 Hz and reverberation levels for 1-octave bands from 200 to 12,800 Hz. Author (GRA)

N72-22432# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
THE STRUCTURE OF THE EARTH'S ATMOSPHERE: LECTURE NOTES
Ernest Bauer Jan. 1972 342 p refs
(AD-736257; p-811; IDA/HQ-71-13439) Avail: NTIS CSCL 04/1

These are lecture notes for a graduate course in applied physics the aim of which is to relate the phenomenology of the different regions of the earth's atmosphere to the underlying physical principles. After an initial discussion of relevant topics in atomic physics, the sun is treated as the primary energy source that drives the atmosphere, which is then treated by moving upward from sea level, region by region, through the troposphere, strato/mesosphere, and thermosphere, analyzing in turn the effects of water vapor and clouds, ozone and oxygen photodissociation. Above 200-300 km this pattern fails because of the geomagnetic field, and here the ionosphere and exosphere are treated as applications of plasma physics. Author (GRA)

N72-22433# Air Force Cambridge Research Labs., L. G. Hanson Field, Mass.
ATMOSPHERIC OPTICS MEASUREMENTS WITH A BALLOON-BORNE NEPHELOMETER Environmental Research Papers
Frank W. Gibson and Frank K. Dearborn 19 Aug. 1971 42 p refs
(Af Proj. 7621)
(AD-736408; AFCRL-71-0455; AFCRL-erp-371) Avail: NTIS CSCL 04/1

A large modified polar nephelometer was constructed for the purpose of making high altitude atmospheric optics measurements. The instrument is balloon-borne and measures the angular volume scattering function from ground to better than 26 km in absolute quantities. The results of the initial flight with the unit are presented and they depict the variability in this parameter over the altitude profile for three scattering angles and four wavelengths. In addition, the polarization and the forward-to-backscatter ratio of the scattered light are shown to be sensitive indicators of the atmosphere's vertical aerosol structure. The import of these preliminary results is, however, in pointing out the capabilities of this instrument, which can provide quantitative information on fundamental optical parameters of the atmosphere without the constraints inherent in other techniques. Author (GRA)

N72-22434# St. Louis Univ., Mo. Dept. of Earth and Atmospheric Sciences.
RESEARCH IN SEISMOLOGY. EARTHQUAKE MECHANISM, MAGNITUDE, SPECTRAL PROPERTIES, AND MODEL STUDIES Annual Technical Report no. 2
Carl Kisslinger 1 Sep. 1971 32 p refs
(Contract F19628-70-C-0036; ARPA Order 0292; AF Proj. 8652)
(AD-736424; AFCRL-71-0517) Avail: NTIS CSCL 08/11

The research may be categorized as work on: earthquake focal mechanisms, earthquake and explosion magnitude and energy determinations, spectral properties of earthquakes and explosions, model studies of strain release and coupling and continued study of regional seismicity. The principal results reported are: an improved technique for determining the best-fitting focal mechanism relation by combining P-amplitude and S-wave polarization data has been developed; a technique for determining the fault plane solution using P-wave amplitude data has been developed. Author (GRA)

N72-22843*# Bellcomm, Inc., Washington, D.C.
SURFACE DISTURBANCES AT THE APOLLO 15 LANDING SITE, PART E
N. W. Hinners and Farouk El-Baz *In* NASA. Manned Spacecraft Center Apollo 15 Prelim. Sci. Rept. 1972 3 p (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 80K

N72-22844*# Geological Survey, Washington, D.C.
REGINAL GEOLOGY OF HADLEY RILLE, PART F
Keith A. Howard and James W. Head (Bellcomm, Inc.) *In* NASA. Manned Spacecraft Center Apollo 15 Prelim. Sci. Rept. 1972 5 p (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 08G

N72-22848*# Geological Survey, Washington, D.C.
PRELIMINARY GEOLOGIC MAP OF THE REGION AROUND THE CANDIDATE PROCLUS APOLLO LANDING SITE, PART J
Don E. Wilhelms *In* NASA. Manned Spacecraft Center Apollo 15 Prelim. Sci. Rept. 1972 4 p (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 08G

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N72-22435 Deutscher Wetterdienst, Offenbach am Main (West Germany).
REPORTS OF THE GERMAN WEATHER SERVICE, VOLUME 16, NO. 126: ON A NEW MODEL OF THE SCHULZE RADIATION BALANCE METER [BERICHTE DES DEUTSCHEN WETTERDIENSTES, BAND 16, NR. 126: UEBER EIN NEUES MODELL DES STRAHLUNGSBILANZMESSERS NACH SCHULZE]
Claus Uwe Daeke 1972 23 p refs In GERMAN; ENGLISH summary
Avail: Issuing Activity

A new model of the Schulze-type balance meter for geophysical observations is described. With this it is possible to measure the radiation balance as well as the radiation directed upward and downward separately. Novelties are the way of leading the air through the apparatus to keep the temperature of the measuring core and to ventilate the Lupolen caps and the use of semiconductor thermocouples as sensitive elements. By special means the apparatus has the same sensitivity for short-wave and for long-wave radiation. The indication of the

balance meter in its dependence on the angle of inclination is well according to the Lambert cosine law. Further is described a new procedure for the calibration of balance meters in the long wave region using a rotating water bath as a source of infrared radiation. It is also shown how to develop an apparatus for measuring the long-wave radiation of the atmosphere by using the upper part of the new balance meter. In an appendix the function of the balance meter is discussed theoretically based upon a simplified model for the heat currents. A comparison is carried out with the experimental results. Author

N72-22436* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
PLATINUM RESISTANCE THERMOMETER CIRCUIT Patent
Louis W. McFadin, inventor (to NASA) Issued 19 Oct. 1971 4 p Filed 16 Mar. 1970
(NASA-Case-MSC-12327; US-Patent-3,613,454;
US-Patent-Appl-SN-19572; US-Patent-Class-73-362AR) Avail: US Patent Office CSCL 14B

A platinum wire resistor is exposed to a temperature to be measured. The voltage drop across the resistor is input to a differential amplifier. The platinum resistor is connected to ground through a sensing resistor. Variations in voltage across the sensing resistor drives the differential amplifier to maintain a constant current through the resistance thermometer and the sensing resistor. A second differential amplifier connected across the resistive thermometer forms an output signal which is related to the temperature of the sensor and hence, proportional to the measured temperature. Official Gazette of the U.S. Patent Office

N72-22437* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MAGNIFYING SCRATCH GAGE FORCE TRANSDUCER Patent
Charles E. Scott, inventor (to NASA) Issued 12 Oct. 1971 7 p Filed 19 Feb. 1970 Supersedes N71-28654 (09 - 16, p 2595)
(NASA-Case-LAR-10496-1; US-Patent-3,611,798;
US-Patent-Appl-SN-12661; US-Patent-Class-73-141A) Avail: US Patent Office CSCL 14B

A passive type force transducer is discussed wherein forces exerted along the longitudinal axis of the transducer are magnified and displayed as a scratch transversely to the direction of force. Official Gazette of the U.S. Patent Office

N72-22438* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
WIDE RANGE DYNAMIC PRESSURE SENSOR Patent
John Dimeff and James W. Lane, inventors (to NASA) Issued 16 Nov. 1971 8 p Filed 4 Dec. 1969 Supersedes N70-20729 (08 - 08, p 1445)
(NASA-Case-ARC-10263-1; US-Patent-3,620,083;
US-Patent-Appl-SN-882122; US-Patent-Class-73-398C) Avail: US Patent Office CSCL 14B

A dynamic pressure sensor is described which consists of a vibrating diaphragm within a cavity with a driving plate on one side of the diaphragm and a sensing plate on the other side. The plates are perforated and spaced from the walls of the cavity so that increases in damping and apparent stiffness, induced by increased pressures, are reduced. By reducing the damping and apparent stiffness, the range of the instrument is greatly increased so that it can be used for measuring high and low pressures. Official Gazette of the U.S. Patent Office

N72-22439* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SHOCK WAVE CONVERGENCE APPARATUS Patent
Edward L. Shriver, inventor (to NASA) Issued 7 Dec. 1971 5 p Filed 31 Dec. 1970
(NASA-Case-MFS-20890; US-Patent-3,626,218;
US-Patent-Appl-SN-103229; US-Patent-Class-310-11;
US-Patent-Class-29-421; US-Patent-Class-264-22;
US-Patent-Class-310-42) Avail: US Patent Office CSCL 14B

An electrical device is described, which develops converging spherical shock waves used to treat materials placed inside two hollow dielectric hemispheres which are fastened together. The device can be used to create phase transformation in crystals, to cause chemical reactions between materials, or to create implosive forces which may be used to compact materials. Wire conductors are wound spirally on the outside of the hemispheres. The device uses a high voltage, high current power supply to create a sudden surge of current through the conductors. This sets up radially converging spherical shock waves in electrical conducting material filling the hemispheres. These shock waves converge on the material to be treated in the center of the cavity created by the two hollow hemispheres.
Official Gazette of the U.S. Patent Office

N72-22440* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
METHOD AND APPARATUS FOR MEASURING THE DAMPING CHARACTERISTICS OF A STRUCTURE Patent
Henry A. Cole, Jr., inventor (to NASA) Issued 16 Nov. 1971 11 p Filed 24 Jan. 1969
(NASA-Case-ARC-10154-1; US-Patent-3,620,069;
US-Patent-Appl-SN-793771; US-Patent-Class-73-67.2) Avail: US Patent Office CSCL 14B

An apparatus for measuring the damping characteristics of a structure or system during excitation by random forces or influences is discussed. The apparatus is composed of at least two parallel sampling circuits which perform time sequential sampling operations on predetermined portions of a given input signal. The corresponding outputs of each sampling circuit are then added together at a plurality of output terminals. From each output terminal a sampling transient indicative of a point on the damping characteristic of the structure can be obtained.
Official Gazette of the U.S. Patent Office

N72-22441* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
OPTICAL BINOCULAR SCANNING APPARATUS Patent
Gary L. Parker and Frederick R. Chamberlain, inventors (to NASA) Issued 12 Oct. 1971 9 p Filed 9 Sep. 1969 Supersedes N70-35433 (08 - 19, p 3540) Sponsored by NASA
(NASA-Case-NPO-11002; US-Patent-3,612,645;
US-Patent-Appl-SN-856328; US-Patent-Class-350-23;
US-Patent-Class-350-19; US-Patent-Class-350-26;
US-Patent-Class-350-35; US-Patent-Class-350-36;
US-Patent-Class-350-49; US-Patent-Class-350-52) Avail: US Patent Office CSCL 17H

An optical scanner is disclosed comprising a linear housing having an optical instrument such as a camera rotatably mounted. A mirror is fixedly mounted in the housing at the optical end of the image sensor at a 45 deg angle to the image plane. An L-shaped housing is provided having one end rotatably mounted on the linear housing with the end being in communication with the optical instrument by reflection from the mirror. A second mirror is mounted at the corner of the L-shaped housing for redirecting the optical path out through the other end. During rotation of the L-shaped housing, the optical instrument is counterrotated to compensate for the image rotation on the first mirror so that, for example on a television monitor, the picture transmitted by the optical instrument would be always upright. Official Gazette of the U.S. Patent Office

N72-22442* Trans-Sonics, Inc., Lexington, Mass.
CAPACITIVE TANK GAGING APPARATUS BEING INDEPENDENT OF LIQUID DISTRIBUTION Patent
Alvin H. Dammig, Jr., Arthur E. Sherburne, and Rodney A. Brooks, inventors (to NASA) Issued 1 Feb. 1972 15 p Filed 27 Jan. 1967 Sponsored by NASA
(NASA-Case-MFS-21629; US-Patent-3,639,835;
US-Patent-Appl-SN-612265; US-Patent-Class-324-61;
US-Patent-Class-73-304) Avail: US Patent Office CSCL 14B

Capacitive gaging apparatus for fluid measurement is described. Longitudinally extending electrodes are circumferentially disposed on the interior of an elongated container of conduit and

energized by a time variable signal to generate a uniform electric field across the container or conduit. In one embodiment, transverse fields are generated across the container. Changes in energizing current are converted to indicate liquid quantity or density. The electrodes may be shielded, formed of variable widths and energized to produce at least alternately orthagonal electric fields to obtain maximum accuracy.

Official Gazette of the U.S. Patent Office

N72-22443* Taag Designs, Inc., College Park, Md.
PHOTOTROPIC COMPOSITION OF MATTER Patent
John B. Schutt, Joe A. Colony, inventors (to NASA), and Donald R. Lepp Issued 1 Feb. 1972 5 p Filed 1 Aug. 1968 Sponsored by NASA
(NASA-Case-XGS-03736; US-Patent-3,639,250; US-Patent-Appl-SN-749320; US-Patent-Class-252-300; US-Patent-Class-96-90PC) Avail: US Patent Office CSCL 14E

This technique provides a phototropic composition of matter comprising: (1) at least one member of the group consisting of lithium and lithium-containing substances; (2) at least one member of the group consisting of rutile or anatase, tin dioxide, and alkaline earth titanates; and (3) at least one member of the group consisting of elements selected from groups 1A, 1B, 2A, 2B, 3A, 3B, 4A, 4B, 5A, 5B, 6B, 7B, and 8, and the rare earth or outer transition series of the periodic table including cerium through lutecium and its compounds. The composition must be sintered until it is sensitive to ultraviolet light upon cooling.

Official Gazette of the U.S. Patent Office

N72-22444* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STAR IMAGE MOTION COMPENSATOR Patent
William E. Howell and Aaron J. Ostroff, inventors (to NASA) Issued 7 Mar. 1972 7 p Filed 28 Apr. 1970 Supersedes N70-35412 (08 - 19, p 3539)
(NASA-Case-LAR-10523-1; US-Patent-3,647,276; US-Patent-Appl-SN-32665; US-Patent-Class-350-16; US-Patent-Class-350-52; US-Patent-Class-356-248; US-Patent-Class-250-203) Avail: US Patent Office CSCL 17H

Technique and hardware in a telescope for maintaining one or more star images fixed on the focal plane is examined. The hardware consists of first and second parallel mirrors that are maintained parallel to each other as they are rotated about an axis through the first mirror. Means are also provided that are responsive to the rotational movement for moving the second mirror to maintain the length of the light path from the first mirror to the focal plane constant.

Official Gazette of the U.S. Patent Office

N72-22445* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ABSOLUTE FOCUS LOCK FOR MICROSCOPES Patent
Russell W. Loop, Max Tongier, Jr., and Clarence D. Cone, Jr., inventors (to NASA) Issued 16 Nov. 1971 5 p Filed 5 Mar. 1970 Supersedes N70-35598 (08 - 19, p 3541)
(NASA-Case-LAR-10184; US-Patent-3,620,595; US-Patent-Appl-SN-16808; US-Patent-Class-350-86; US-Patent-Class-33-1745) Avail: US Patent Office CSCL 20F

An apparatus is described for securing absolute arrest and immobilization of the specimen stage of a microscope in a preset state of focus. The device is capable of maintaining a set focus for a long period of time as is required in time-lapse cinephotography of biological specimens.

Official Gazette of the U.S. Patent Office

N72-22446*# Geological Survey, Washington, D.C.
EVALUATION OF THE MSFC FACSIMILE CAMERA SYSTEM AS A TOOL FOR EXTRATERRESTRIAL GEOLOGIC EXPLORATION
E. W. Wolfe and J. D. Alderman Oct. 1971 65 p
(NASA Order H-82013A)
(NASA-CR-123596; Rept-40) Avail: NTIS CSCL 14E

Utility of the Marshall Space Flight (MSFC) facsimile camera system for extraterrestrial geologic exploration was investigated during the spring of 1971 near Merriam Crater in northern Arizona. Although the system with its present hard-wired recorder operates erratically, the imagery showed that the camera could be developed as a prime imaging tool for automated missions. Its utility would be enhanced by development of computer techniques that utilize digital camera output for construction of topographic maps, and it needs increased resolution for examining near field details. A supplementary imaging system may be necessary for hand specimen examination at low magnification. Author

N72-22447*# TRW Systems, Redondo Beach, Calif. Navigation and Optimization Section.
EARTH RESOURCES DATA SYSTEMS DESIGN: S192 INSTRUMENT MEASUREMENTS AND CHARACTERISTICS
A. S. Goldstein 14 Mar. 1972 46 p refs
(Contract NAS9-12330)
(NASA-CR-115499; TRW-20029-H060-R0-00) Avail: NTIS CSCL 14B

The design, development, and characteristics of the S192 instrument for use with the earth resources data systems are discussed. Subjects presented are: (1) multispectral scanner measurements, (2) measurement characteristics, (3) calibration and aligment, (4) operating modes, and (5) time tagging and references. The S192 will obtain high spatial resolution, quantitative line scan imagery data of the radiation reflected and emitted by selected test sites in up to 13 spectral bands of visible, near infrared, and thermal infrared regions of the electromagnetic spectrum. Author

N72-22448# Editura Academiei Republicii Socialiste Romania, Bucharest.
THE BASES OF RADIOLOGIC DEFECTOSCOPY
M. Gr. Nastase 1970 260 p refs In ROMANIAN; ENGLISH summary
Avail: NTIS

The use of radiologic defect analysis in destructive and nondestructive testing is considered. Theory and fundamental principles are presented. X-ray and gamma ray sources are reviewed, and applications of the methods of defect analysis in industry are set forth. K.P.D.

N72-22449# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
VELOCITY MEASUREMENTS IN GAS AND LIQUID FLOWS WITH AN INTERFERENTIAL VELOCIMETER
Alain Boutier and Michel Philbert 1972 9 p
(ONERA-TP-1059) Avail: NTIS

An interferential velocimeter using forward scattering is described together with the results which were obtained in a wind tunnel, into which were injected twenty-micron glass balls and one-micron marble particles. For comparison a method using black-background photography and two pulsed ruby lasers was tested in the same wind tunnel. Typical results are shown. Another interferential velocimeter, using back scattering, was tested on plain tap water flows; the results obtained are briefly summarized. The principle of a two-component interferential velocimeter using two wavelengths is presented. Author

N72-22450# Australian National Univ., Canberra. Dept. of Nuclear Physics.
A COMPACT NEUTRON DETECTOR USING RESONANT SCATTERING FROM LITHIUM TO IDENTIFY LEVELS FOLLOWING NEUTRON PRODUCING REACTIONS
R. A. I. Bell, J. V. Thompson, I. G. Graham, and W. F. Davidson [1967] 9 p refs
(ANU-P/536) Avail: NTIS

This instrument utilizes the sole sharp neutron scattering resonance of Li -7 at 258 keV. Neutrons from a reaction are collimated on to a target of lithium metal. The scattered and

transmitted fluxes are detected in highly efficient He -3 proportional counters surrounded by heavily shielded paraffin moderators. The ratio of these fluxes peaks sharply whenever the energy of a neutron group is on resonance, so that the excitation function of the ratio displays peaks corresponding to levels of the final nucleus. The present instrument is somewhat smaller and more mobile than previously described versions. Author

N72-22451# Australian National Univ., Canberra. Dept. of Nuclear Physics.
REDRIFT TREATMENT OF RADIATION DAMAGED Si(Li) DETECTORS
N. H. Merrill, D. Thomas, and S. Whineray [1971] 10 p refs
(ANU-P/541) Avail: NTIS

Details are given of a redrift system currently in to restore the compensation in the intrinsic region of radiation detectors. The method followed is that in which the detectors are maintained under reverse bias conditions at a temperature of about 60 C for several days. It is pointed out that while this technique is capable of removing the dead layer effect, the charge trapping centers will remain. Author

N72-22452*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LOW POWER ELECTROMAGNETIC FLOWMETER PROVIDING ACCURATE ZERO SET Patent Application
Thomas B. Fryer, inventor (to NASA) Filed 12 Nov. 1971 16 p
(NASA-Case-ARC-10362-1; US-Patent-Appl-SN-198289) Avail: NTIS CSCL 14B

A low power, small-size electromagnetic flowmeter system is described, which produces a zero output signal for zero flow. The system comprises an air-core-type, electromagnetic flow transducer, a field current supply circuit for the transducer coils, and a preamplifier and demodulation circuit connected to the output of the transducer. To prevent spurious signals at zero flow, separate, isolated power supplies are provided for the two circuits. The demodulator includes a pair of synchronous rectifiers which are controlled by signals from the field current supply circuit. Pulse transformers connected in front of the synchronous rectifiers provide isolation between the two circuits. NASA

N72-22453*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
IMAGE DATA RATE CONVERTER Patent Application
Frederic C. Billingsley, inventor (to NASA) Filed 22 Feb. 1972 14 p
(Contract NAS7-100)
(NASA-Case-NPO-11659-1; US-Patent-Appl-SN-228189) Avail: NTIS CSCL 14C

A data rate converter is described, which is comprised of a rotatable data storing drum with at least one fixed read/record head, and a rotatable read/record head. The latter is rotatable in a circular path about the drum axis of rotation. The drum may be positioned in any one of a number of axial positions with respect to the heads, so that at least one drum track is aligned with the fixed head in one drum position. When a track is aligned with the fixed head, data may be recorded therein or read out at a rate which is a function of drum rotation. When aligned with the rotatable head, data may be recorded or read out at a rate which is a function of the rates and directions of rotation of both the drum and the head. NASA

N72-22454*# Stanford Research Inst., Menlo Park, Calif.
ANALYSIS OF ATS PHOTOGRAPHS USING A SPECIALLY DESIGNED ELECTRONIC CONSOLE Final Report, 8 Oct. 1970 - 8 Oct. 1971
Roy H. Blackmer, Jr., William Viezee, and Russell M. Trudeau 8 Oct. 1971 91 p refs
(Contract NAS5-21086; SRI Proj. 8244)
(NASA-CR-122373) Avail: NTIS CSCL 14E

Measurements of cloud motion, cloud size, and growth rate were made on four days in the vicinity of rawin stations in the BOMEX network. These measurements were compared with the rawins and levels of best fit ranging from 980 to 250 mb were found. No correlation was found between cloud size and level of best fit. The magnitude of the vector difference between the cloud motion and wind at the level of best fit was as high as 15 knots for clouds with levels of best fit below the 500-mb level and 8 knots for clouds with levels of best fit above the 500-mb level. When cloud motion vectors with levels of best fit at or above the 500-mb level were compared with winds at the 300-mb level, the vector difference increased to as much as 16 knots or double the greatest minimum vector difference. A comparison between cloud motions and winds at the level of best fit showed that the clouds tended to move slightly faster than the observed winds and to move slightly to the left of the wind direction. Rate of growth appeared to influence whether clouds moved faster or slower than the wind. No relationship between cloud size and amount of deviation from the wind direction was observed. Author

N72-22455*# Beckman Instruments, Inc., Fullerton, Calif. Advanced Technology Operations.
QUALIFICATION TEST UNIT SLIDE STAINER (BECKMAN P/N 673753) Final Report
P. S. Bernier Mar. 1972 144 p
(Contract NAS9-12473)
(NASA-CR-115534) Avail: NTIS CSCL 14B

Specifications for a slide stainer unit for the Skylab program are presented. The qualification test slide stainer was designed to be a self-contained system capable of performing an eight-step Gram stain of microorganisms and a Wright's stain of blood smears. K.P.D.

N72-22456# Kiel Univ. (West Germany). Inst. fuer Reine und Angewandte Kernphysik.
THE CONSTRUCTION OF AN ELECTRON SPECTROMETER AND MEASUREMENTS OF MeV-ELECTRONS IN THE MORNING SECTOR OF THE POLAR ZONE
J. Boehm Munich Bundesministerium fuer Bildung und Wiss. Jan. 1972 185 p refs In GERMAN, ENGLISH data
(BMBW-FB-W-72-02) Avail: NTIS; ZLDI Munich: DM 38,85

The construction of an electron spectrometer and its application for measuring electron flux in the morning sector of the polar zone are discussed. The spectrometer was used during rocket flights from Norway. Electrons in the energy range of 2.5 to 3.5 MeV were detected at heights of 80 to 217 kilometers. Based on correlation with previously obtained data, it is concluded that the electron precipitation is caused by an expansion of the earth's magnetic field. Author

N72-22457*# Techtran Corp., Glen Burnie, Md.
MAXIMUM-MINIMUM THERMOMETER FOR DETERMINING SOIL TEMPERATURE AT A DEPTH OF THE TILLERING NODE OF WINTER CROPS
L. A. Shestopalov and B. E. Spektor Washington NASA Apr. 1972 15 p refs Transl. into ENGLISH from Tr. Nauchn.-Issled. Inst. Gidromet. Priborostr. (Leningrad), no. 12, 1964 p 113-122
(Contract NASw-2037)
(NASA-TT-F-14227) Avail: NTIS CSCL 14B

The maximum-minimum manometric thermometer designed for measuring and recording extremal temperatures of the soil at the depth of the tillering node of winter crops during winter and early spring is described. Its basic technological characteristics, principles of calculating individual nodes and errors, and results of laboratory and preliminary field tests are presented. Author

N72-22458*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD FOR MEASURING STATIC YOUNG'S MODULUS OF TUNGSTEN TO 1900 K
William T. Harrigill, Jr. and Alois Krsek, Jr. Washington Apr. 1972 17 p refs

(NASA-TN-D-6794; E-6702) Avail: NTIS CSCL 14B

An instrument system was developed and tested to measure static Young's modulus of elasticity of refractory metals in tension at temperatures to 1900 K. The extensometer uses capacitance displacement sensors for measuring total elongation of a specimen and incorporates a unique high-resolution remote zero-adjusting mechanism. Details of a method for calibrating capacitance displacement sensors at temperatures to 800 K are included. The system was built to adapt to a vacuum furnace on a tensile machine and was tested on unalloyed tungsten rod specimens. The test results show that the system can measure the modulus of tungsten to 1900 K to within a precision of + or - 5 percent. The uncertainty of the measurement is estimated to be of the same order as the precision. Author

N72-22459# Panametrics, Inc., Waltham, Mass.

DESIGN AND FLIGHT OF CHARGED PARTICLE DETECTION SYSTEMS FOR ROCKET EXPERIMENTS Final Report, 20 Oct. 1966 - 31 Aug. 1971

Frederick A. Hanser, Bach Sellers, and Paul R. Morel Aug. 1971 38 p refs

(Contract F19628-67-C-0123; AF Proj. 7601)

(AD-736417; AFCRL-71-0484) Avail: NTIS CSCL 18/4

Six auroral particle detection systems for use on rockets have been constructed, flown, and the data returned used to evaluate instrument performance. The systems consist of an electrostatic analyzer (ESA) for electrons of 1 to 10 (or 15) keV, an electron scintillator-photomultiplier combination for 10 to 200 keV electrons, and a solid state detector for 0.3 to 3 MeV protons. One payload used a CsI(Tl) crystalphotomultiplier in place of the solid state detector to measure 0.68 to 7.28 MeV rocket launches. The particle detection payload has proven to be quite reliable and, except for necessary modification of the ESA, should be useful for future rocket flights. Author (GRA)

N72-22460# European Organization for Nuclear Research, Geneva (Switzerland). Nuclear Physics Div.

FIVE-CHANNEL STROBED COINCIDENCE UNIT

M. Moore and H. Verweij 28 Oct. 1971 18 p refs

(CERN-71-2) Avail: AEC Depository Libraries

The instrument described contains five independent single input channels which can be gated by a common strobe signal. Each channel has a front-panel switch giving the choice of making it subject to the common signal or not. The minimum input width is 1.5 nsec and the minimum strobe width is 2 nsec. The maximum frequency of operation is at least 50 MHz with the standardized output width of 8.5 nsec and could be increased by reducing the output width. One logic and one complementary logic output are provided for each channel. The unit, type N6236, has been designed to accept standard NIM signal levels and is part of the CERN-NIM compatible nucleonic instrument range. Author (NSA)

N72-22461# Los Alamos Scientific Lab., N.Mex.

SHIRX: A HIGH RESOLUTION ROCKET BORNE X-RAY SPECTROMETER

S. Singer, W. P. Aiello, J. A. Bergey, F. J. Edeskuty, and K. D. Williamson 1971 8 p refs Presented at Nucl. Sci. Symp., San Francisco, 3 Nov. 1971 Sponsored by AEC

(LA-DC-12766; Conf-711111-19) Avail: NTIS

A rocket-borne X-ray spectrometer is described, which used cooled, lithium-drifted semiconductor detectors to measure the differential X-ray energy spectrum of Sco-XR-1 in the range 0.6 to 20 keV. Author (NSA)

N72-22462# Atlantic Richfield Hanford Co., Richland, Wash. Chemical Processing Div.

CAPACITANCE PROBE INTERROGATOR INSTRUMENT DESCRIPTION AND MAINTENANCE MANUAL

G. E. Martin Apr. 1972 40 p refs

(Contract AT(45-1)-2130)

(ARH-2047) Avail: NTIS

A capacitance probe detector is described for measuring the liquid level in a vessel, for example the level of a radioactive solution in a sealed vessel. The circuit operation, calibration instructions, trouble shooting, drawings, and fabrication procedure are discussed. NSA

N72-22463# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Teoreticheskoi i Eksperimentalnoi Fiziki.

CALCULATION OF THE CHARACTERISTICS OF A MAGNETIC MISSING-MASS SPECTROMETER

A. M. Blagorodov, I. N. Borodina, V. N. Luzin, I. A. Radkevich, V. V. Jokolovskii, Yu. F. Tomashuk, and V. A. Yushchenko 1970 52 p refs In RUSSIAN; ENGLISH summary

(ITEF-843) Avail: AEC Depository Libraries

The methods for calculation of characteristics and the characteristics of a magnetic missing mass spectrometer are described. These include the efficiency of the spectrometer, the boundaries of the phase volume for the variables, and the reaction angle-recoil particle momentum. The calculated results are compared with the experimental data. Author (NSA)

N72-22464# Bhabha Atomic Research Centre, Bombay (India).

CONSTANT ACCELERATION MOESSBAUER SPECTROMETER

C. K. Mathews 1971 10 p refs

(BARC-551) Avail: AEC Depository Libraries

A constant acceleration Moessbauer spectrometer is described. It consists of an electromechanical transducer, and electronic control unit to drive the transducer, a counting system and a multichannel analyzer operating in the time mode. The line width and the linearity of the velocity scale are shown to be quite satisfactory. A dipstick type cryostat is used in low temperature measurement Author (NSA)

N72-22465# Atomic Energy Establishment, Cairo (Egypt). Engineering and Scientific Instruments Dept.

HIGH LEVEL NONOVERLOAD PULSE AMPLIFIER FOR NUCLEAR MEASUREMENTS

Nabil N. Hanna 1971 28 p refs

(UARAEE-115) Avail: AEC Depository Libraries

A nonoverload high level pulse amplifier designed for use with fast ionization chambers and proportional and scintillation counters is described. The amplifier can amplify linearly, either positive or negative pulses of amplitudes up to 10 V. The amplifier will deliver a positive going output pulse over the range 0 to 150 V with a nonlinearity of less than 1%. Saturation occurs at an output pulse height on the order of 180 V. The amplifier can handle, at its maximum gain setting, input pulses of height up to 20 V without overloading. The upper half frequency of the amplifier is of the order of 3 MHz and the long and short term gain stability is approximately 1%. Pulse shaping and discrimination level facilities are incorporated which make the amplifier particularly useful for coincidence work and counting in the presence of a high background. The instrument has been used for more than twelve months and has proved to be reliable. Author (NSA)

N72-22466# Oak Ridge National Lab., Tenn.

GENERAL SURVEY OF ELECTRON SPECTROSCOPY

Thomas A. Carlson 1971 45 p refs Presented at Intern Conf. on Electron Spectroscopy, Pacific Grove, Calif., 7-10 Sep. 1971 Sponsored by AEC

(Conf-710909-3) Avail: NTIS

A review of recent research in electron and photoelectron spectroscopy is presented. The basic phenomena of electron spectroscopy are considered. X-ray radiation and Auger processes are discussed in this regard. Developments in Auger spectroscopy and chemical shift studies are also considered. The meaning of binding energy, the study of solids by electron spectroscopy, and resolution, and the problems they present, are summarized. K.P.D.

N72-22467# Sandia Labs., Albuquerque, N.Mex.
OPTICAL VOLTMETERS
Philip D. Thacher Oct. 1971 52 p refs Sponsored by AEC
(SC-RR-710542) Avail: NTIS

A voltage monitoring system has been investigated in which light guides take the voltage information from the sensor to the readout device. This optical voltmeter system, consisting of a light source, a small electrooptic voltage sensor with attached light guides, and a light detector and readout setup, was specifically developed for monitoring 28 V arming signals applied while testing a capacitive discharge unit during manufacture and storage. Tests showed that the voltmeters were able to determine voltages between 0 and + 50 volts to plus or minus 1 volt with a response time of about 0.5 msec. The voltmeter's temperature sensitivity and the small effects of drift and hysteresis were also measured. Small, low power light sources, light detectors, and amplifiers have been identified for use in the voltmeter system.

Author

N72-22468# Pittsburgh Univ., Pa.
MICROWAVE-OPTICAL DOUBLE RESONANCE SPECTROSCOPY Annual Report, 1971
David W. Pratt 1 Nov. 1971 12 p refs
(Contract AT(11-1)-3435)
(NYO-4263-1) Avail: NTIS

The modification and development of equipment used in microwave optical double resonance experiments are reported. Specifically, a liquid helium cryostat equipped with a quartz tail section was constructed, the Bruker EPR spectrometer was modified for pulsed microwave operation, and a combination light pipe-fiber optic assembly was installed in the sample cavity to allow observation of the resolved triplet state phosphorescence with high efficiency. The system was tested by successfully detecting the EPR spectrum of triplet naphthalene-d8 in PMMA at 2 K while simultaneously monitoring its phosphorescence. In addition, use was made of the adamantane matrix technique for the preparation and characterization of free radicals produced by x-irradiation of unsaturated hydrocarbons. The EPR spectra of a wide variety of substituted allyl radicals were obtained and assigned using this method. Finally, the utility of this matrix for optical absorption studies of free radicals was demonstrated.

Author

N72-22469# California Univ., Livermore. Lawrence Radiation Lab.
PORTABLE Ge(Li) DETECTOR FOR FIELD MEASUREMENT OF RADIONUCLIDES IN THE ENVIRONMENT
P. L. Phelps, L. R. Anspaugh, J. J. Korando, and G. W. Huckabay 15 Nov. 1971 24 p refs Presented at IEEE Nucl. Sci. Symp., San Francisco, 3-5 Nov. 1971 Submitted for publication Sponsored by AEC
(UCRL-73561; Conf-711111-25) Avail: NTIS

A description of a portable Ge(Li) field spectrometer and its application to in situ measurements is given. The mathematical techniques of calibrating the spectrometer so that field spectrometer counting rates may be converted into units of soil activity are developed. The quantification of gamma-ray emitting radionuclides in the field has proven to be more sensitive than laboratory analysis using Ge(Li) anticoincidence shielded spectrometers. This was demonstrated by obtaining approximately the equivalent statistical accuracies for quantifying several radionuclides from a 30 min field count as compared to a 1437 min laboratory analysis. A comparison between the results obtained from field analysis with those obtained by returning the samples to the laboratory are given for natural radionuclides and Cs-137. An example of qualitative spectral data obtained from field measurements of gaseous emissions from a BWR reactor is also given.

Author (NSA)

N72-22470# California Univ., Livermore. Lawrence Radiation Lab.
HIGH STABILITY PULSER AND CHARGE INJECTION CAPACITOR FOR SERVOSTABILIZATION OF HIGH RESOLUTION GAMMA RAY SPECTROMETERS
Arne E. Bradley 25 Oct. 1971 24 p refs Presented at the Nucl. Sci. Symp., San Francisco, 3-5 Nov. 1971
(UCRL-73247; Conf-711111-15) Avail: NTIS

The design of a reference pulser and air-dielectric capacitor for use in stabilization of high-resolution Ge(Li) gamma-ray spectrometers is discussed. Additionally, the adverse effects of coaxial cable series resistance and detector coupling capacitor instability are considered. The reference pulser circuitry is completely transistorized and features a highly-stable dual-transistor pulse generation network. The long-term stability is approximately + or - .02 channels per day. The air-dielectric capacitor is a three-terminal device constructed of Kowar-steel and glass. The rigid glass-metal seal insures long-term stability. The capacitance temperature coefficient from liquid nitrogen to room temperature is approximately +10 ppM/C deg. Data are presented which shows that the series resistance of coaxial cable will cause significant pulse drift when terminated and essentially no drift if left unterminated. An analysis also indicates that drift in a detector coupling capacitor can produce uncorrectable spectral drift.

Author (NSA)

N72-22471# California Univ., Livermore. Lawrence Livermore Lab.
EXPERIENCE IN THE USE OF AN ANTICOINCIDENCE SHIELDED Ge(Li) GAMMA RAY SPECTROMETER FOR LOW LEVEL ENVIRONMENTAL RADIONUCLIDE ANALYSIS
P. L. Phelps and K. O. Hamby 25 Oct. 1971 28 p refs Presented at the Nuc. Sci. Symp., San Francisco, 3-5 Nov. 1971
(UCRL-73521; Conf-711111-18) Avail: NTIS

An evaluation of a low level, high resolution anticoincidence shielded Ge(Li) spectrometer, constructed over five years ago, was made. The evaluation was based upon results obtained in assaying a variety of biological and environmental samples, each contained in a 200 cm3 aluminum can. The spectrometer used an 18 cm3 planar type Ge(Li) detector. An example of the very high sensitivity possible with the spectrometer was in the assaying for Cs-137 in a 296 gram soil sample which was determined to have a concentration of 0.027 pCi of Cs-137 per gram of soil. Description of the spectrometer, methods used in data analysis and results of counting low level samples are given.

Author (NSA)

N72-22472# Aeronautical Quality Assurance Directorate, Uxbridge (England).
THE USE OF PAPER-BASED EMULSIONS IN INDUSTRIAL RADIOGRAPHY
J. C. Rockley and D. A. Croft Apr. 1971 34 p refs
(AQD/XNDT-001158; BR-24924) Avail: NTIS

The radiographic characteristics of four types of photographic paper are investigated. It is found that a developer-incorporated printing paper, when exposed in conjunction with a fluorescent slat screen, is capable of giving radiographs of surprisingly high quality when produced at radiation energies not exceeding 200 KV. The economic advantages arising from the use of this type of radiograph in suitable applications are discussed.

Author (ESRO)

N72-22473# Royal Aircraft Establishment, Farnborough (England).
AN ALBEDO HORIZON SENSOR USING HYBRID CIRCUITRY
A. K. Brookman Jul. 1971 20 p
(RAE-TR-71153; BR-26780) Copyright. Avail: NTIS

Successful operation of an albedo horizon sensor using hybrid circuitry was demonstrated in the flight of Skylark SL 904. Two sensors were flown, each having an array of 16 detector elements and the vehicle roll angle was measured over a 60 deg range to an accuracy estimated to be about 0.3 deg (3 sigma). Details are given of the construction and operation of the sensors and suggestions made for future applications.

Author (ESRO)

N72-22474# British Iron and Steel Research Association, London (England). Metallurgy Dept.
MEASUREMENT OF SUB-CRITICAL FLAW GROWTH IN STRESS CORROSION, CYCLIC LOADING AND HIGH TEMPERATURE CREEP BY THE DC ELECTRICAL RESISTANCE TECHNIQUE
P. McIntyre and A. H. Prienst Nov. 1971 19 p refs
(PB-205101; MG/54/71) Avail: NTIS CSCL 14B

The dc electrical resistance technique was applied to the measurement of subcritical flaw growth in fracture toughness specimens of different geometries under conditions of stress corrosion, cyclic loading, and high temperature creep. The technique was developed to give a linear potential change as a function of crack length, combined with maximum sensitivity. Comparisons made between this technique and the ultrasonic technique enabled several sources of error to be identified and corrections to be made for these. Author (GRA)

N72-22475# Commonwealth Scientific and Industrial Research Organization, Glen Osmond (Australia). Div. of Soils.
COMPUTER PROGRAMS FOR USE IN X-RAY SPECTROGRAPHY-DETERMINATION OF TRACE ELEMENTS AND OF DEAD-TIME OF COUNTERS
A. C. Oertel 1971 17 p refs
(PB-204592; Tech-Paper-5) Avail: NTIS CSCL 07D

Computer programs for use in X-ray spectrography are described. Two are for determination of trace elements: one where only the analysis line is subject to interference, the other where both analysis line and adjacent background are subject to interference. The third program is for determining the dead-time of counters. Author (GRA)

N72-22476# Army Edgewood Arsenal, Md. Chemical Research Lab.
AN APPARATUS FOR HIGH-PRESSURE THERMOGRAVIMETRY Final Report, Apr. 1967 - Dec. 1969
Harry A. Brown, Jr., Elwin C. Penski, and John J. Callahan Dec. 1971 14 p refs
(DA Proj. 1W0-62116-AD-10)
(AD-736329; EA-SP-100-97) Avail: NTIS CSCL 14/2

Construction and operation of a high-pressure thermobalance usable to 300 psig and a temperature of 350 C is described. A modified, commercially available balance mechanism and associated circuitry provide an apparatus that is easily constructed and has satisfactory performance characteristics. Thermograms are presented to show typical operation and performance of the apparatus, using aniline to demonstrate retardation of evaporation and copper sulfate pentahydrate to show relatively unchanged decomposition rates with increased pressure. Author (GRA)

N72-22477# Aerospace Corp., San Bernardino, Calif.
PRECISION CENTRIFUGE TESTING OF AN ACCELEROMETER Technical Report Oct. 1970 - Sep. 1971
George H. Neugebauer 15 Sep. 1971 66 p refs
(Contract F04701-71-C-0172)
(AD-736435; TR-0172(S2970-10)-1; SAMSO-TR-71-333) Avail: NTIS CSCL 14/2

A simple, mathematically correct procedure for reducing accelerometer data obtained on a precision centrifuge is presented. The procedure provides a means of optimally separating even and odd terms and is applicable to the determination of all the nonlinear coefficients of the assumed model equation. The effect of the radial acceleration gradient and of rotation are investigated. Criteria for establishing the statistical significance of the coefficients and the validity of the model equation are also presented. Author (GRA)

N72-22478# Northwest Environmental Technology Labs., Inc., Bellevue, Wash.
OPERATION OF THE SECEDE 2 LOBE-SWEEP INTERFEROMETERS Technical Report, 1 Dec. 1970 - 31 Jan. 1971
John M. Lansinger and Maurice H. Evans, Jr. Mar. 1971 58 p
(Contract F30602-71-C-0023; ARPA Order 1057; Proj. Secede)
(AD-736035; NETL-2; RADC-TR-71-236; TR-2) Avail: NTIS CSCL 04/1

Two pairs of twin-element, lobe-sweep radio interferometers were designed, constructed, bench-tested and operated in the field during the SECEDE II test series. One pair operates at a frequency of 145.7644 MHz, the other at 437.2932 MHz. The total of four interferometers is realized with three circularly polarized, broadband log-periodic antennas spaced equally along a two-hundred-meter baseline with the center antenna common to each interferometer pair. Author (GRA)

N72-22479# Comstock and Wescott, Inc., Cambridge, Mass.
RESEARCH DIRECTED TOWARD DESIGN OF INSTRUMENTATION FOR INVESTIGATIONS OF AEROSPACE BY ROCKET AND SATELLITE PROBE TECHNIQUES Final Report, 1 May 1968 - 31 Jul. 1971
William P. Verdi 1 Sep. 1971 69 p refs
(Contract F19628-68-C-0307; AF Proj. 8617)
(AD-736425; AFCRL-71-0516) Avail: NTIS CSCL 04/1

The report provides detailed design information for electronic and mechanical instrumentation furnished for use on rocket and satellite-borne experiments and associated ground support equipment. These experiments were concerned with the detection and measurement of charged-particle phenomena and electric fields in the space environment. Items designed, developed and fabricated under this contract include: experimental programmers, voltage power supplies, charged particle sensors, electric field sensors, extendible spacecraft appendages (booms), ground support equipment, etc. photographs, schematics, diagrams, etc. for typical components are included in the report. Author (GRA)

N72-22280*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A CONTAMINATION EXPERIMENT INVESTIGATING THE FAILURE OF THE NIMBUS 4 FILTER WEDGE SPECTROMETER
Raymond Kruger *In its* Space Simulation 1972 p 469-485 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

N72-22282*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
AN INSTRUMENT FOR REAL TIME DETECTION OF CONTAMINATION IN SPACE ENVIRONMENTAL TESTS CHAMBERS
Robert G. Richmond and Henry N. Harmon (Boeing Co.) *In its* Space Simulation 1972 p 503-519 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

N72-22297*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPACECRAFT APPLICATIONS OF QUADRUPOLE MASS SPECTROMETRY
Matthew P. Thekaekara *In its* Space Simulation 1972 p 769-785 refs (See N72-22250 13-11)
(Paper-68) Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

N72-22298*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
DIRECTIONAL MOLECULAR FLOW ANALYSIS AND LEAK DETECTION WITH A ROTATABLE GAS ANALYZER IN A LARGE SPACE SIMULATION CHAMBER
Horst K. F. Ehlers *In its* Space Simulation 1972 p 789-801 ref (See N72-22250 13-11)
(Paper-70) Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

N72-22299*# McDonnell Aircraft Corp., St. Louis, Mo.
RESIDUAL GAS ANALYZER CALIBRATION
R. H. Lilienkamp *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 803-814 refs (See N72-22250 13-11)
(Paper-71) Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 14B

N72-22300*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A COMPARISON OF QUARTZ CRYSTAL MICROBALANCE MEASUREMENTS WITH MASS SPECTROMETER DETERMINATIONS
Raymond Kruger, John J. Scialdone, and Harold Shapiro *In its* Space Simulation 1972 p 815-830 refs (See N72-22250 13-11)
(Paper-72) Avail: NTIS; SOD $4.50 as NAS1-21:298 CSCL 14B

N72-22842*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APOLLO 15 LASER ALTIMETER, PART D
F. L. Robertson and W. M. Kaula (Calif. Univ., Los Angeles) *In* NASA. Manned Spacecraft Center Apollo 15 Prelim. Sci. Rept. 1972 2 p ref (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 20E

N72-22856*# Bellcomm, Inc., Washington, D.C.
NEAR-TERMINATOR PHOTOGRAPHY, PART R
J. W. Head and D. D. Lloyd *In* NASA. Manned Spacecraft Center Apollo 15 Prelim. Sci. Rept. 1972 6 p (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 14E

N72-22857*# Bellcomm, Inc., Washington, D.C.
FIRST EARTHSHINE PHOTOGRAPHY FROM LUNAR ORBIT, PART S
D. D. Lloyd and J. W. Head *In* NASA. Manned Spacecraft Center Apollo 15 Prelim. Sci. Rept. 1972 7 p (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 14E

N72-22858*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ASTRONOMICAL PHOTOGRAPHY, PART T
L. Dunkelman, R. D. Mercer (Dudley Obs.), C. L. Ross (High Altitude Obs.), and A. M. Worden *In* Its Apollo 15 Prelim. Sci. Rept. 1972 39 p refs (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 14E

N72-22393# Norwegian Defence Research Establishment, Kjeller.
THE GEOSTATIONARY SATELLITE AS A DETECTOR OF ULTRAVIOLET SUNRISE AND SUNSET
R. J. Armstrong *In* ESRO The ESRO Geostationary Magnetospheric Satellite Mar. 1971 p 181-182 ref (See N72-22377 13-13)
Avail: NTIS

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N72-22480 Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
ULTRASONIC EXAMINATION AND INSPECTION OF CAST STEEL BLOCKS
L. X. Nepomuceno and M. F. Barbosa 26 Jul. 1971 19 p refs In PORTUGUESE; ENGLISH summary
(Rept-7107.526) Avail: Issuing Activity

The results of ultrasonic inspection of 46 cast steel blocks are presented. The equipment and procedures are described along with the defects found in eight of the blocks. Schematic drawings and photographs of the echograms of the defects are included. Transl. by F.O.S.

N72-22481 Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
ULTRASONIC INSPECTION AND EXAMINATION OF CAST STEEL BLOCKS
L. X. Nepomuceno, M. F. Barbosa, and M. I. Itami 15 Sep. 1971 8 p refs In PORTUGUESE; ENGLISH summary
(Rept-7109.535) Avail: Issuing Activity

The report describes the equipment, accessories and adopted procedure for the ultrasonic inspection and examination of a set of cast steel blocks. The results are presented in schematic drawing form, with defect positioning. Author

N72-22482* Sperry Rand Corp., Phoenix, Ariz.
ISOLATION COUPLING ARRANGEMENT FOR A TORQUE MEASURING SYSTEM Patent
Lawrence P. Davis, James E. Crutcher, and Jerald H. Weidenhamer, inventors (to NASA) Issued 19 Oct. 1971 4 p Filed 29 Nov. 1969 Supersedes N70-26810 (08 - 13, p 2390) Sponsored by NASA
(NASA-Case-XLA-04897; US-Patent-3,613,457; US-Patent-Appl-SN-880249; US-Patent-Class-73-133) Avail: US Patent Office CSCL 13E

A coupling arrangement is described for isolating the torque loads from axial, radial, and bending loads in a load path having a torque measuring transducer. This eliminates errors in torque measurement resulting from their imposition on the transducer, while retaining substantial support for these loads. This is attained by the use of a pair of flexures connected in parallel in the load path which have complementary load bearing characteristics, the first one compliant to radial, axial, and bending loads and rigid under torque, the second having opposite characteristics, with the transducer measuring the torque carried by the first flexure.
Official Gazette of the U.S. Patent Office

N72-22483* Electro-Optical Systems, Inc., Pasadena, Calif.
SCREEN PARTICLE SEPARATOR Patent
Douglas G. Ritchie, inventor (to NASA) Issued 26 Oct. 1971 6 p Filed 6 Oct. 1969 Supersedes N70-35588 (08 - 19, p 3548) Continuation-in-part of US Patent Appl. SN-700120, filed 24 Jan. 1968 Sponsored by NASA
(NASA-Case-XNP-09770-2; US-Patent-3,615,021; US-Patent-Appl-SN-864039; US-Patent-Class-209-349) Avail: US Patent Office CSCL 14B

A mechanism is discussed which is useful in an unmanned spacecraft for screening a soil sample to obtain particles for television viewing. The mechanism comprises a bin for receiving the soil sample, apparatus for rapidly oscillating the bin about a pivot to create centrifugal forces pushing the soil particles through coarse and fine screens, a heated plastic sheet for receiving particles thrown out of the bin, and a translating mechanism for carrying the plastic to a vidicon tube. The translating mechanism includes slides which move along rods, each rod hermetically enclosed within a bellows to prevent the evaporation of lubricants.
Official Gazette of the U.S. Patent Office

N72-22484* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CRYOGENIC FEEDTHROUGH Patent

Edward J. Roberts, inventor (to NASA) Issued 7 Dec. 1971 3 p Filed 20 Oct. 1969 Supersedes N70-20714 (08 - 08, p 1451)
(NASA-Case-LAR-10031; US-Patent-3,625,018;
US-Patent-Appl-SN-867851; US-Patent-Class-62-55.5) Avail: US Patent Office CSCL 13K

A method is described for transferring liquid nitrogen through the chamber wall of a vacuum system to a cryopanel. The penetration is accomplished by using a double-wall tube. The inner tube is connected to the liquid nitrogen source and the cryopanel. The outer tube is mounted to the vacuum wall. This system is considered to minimize cold spots and frost buildup on the chamber wall. F.O.S.

N72-22485* Martin Marietta Corp., Denver, Colo.
FLEXIBLE/RIGIDIFIABLE CABLE ASSEMBLY Patent
Cletus J. Siebert, inventor (to NASA) Issued 7 Dec. 1971 5 p Filed 21 Sept. 1970 Sponsored by NASA
(NASA-Case-MSC-13512-1; US-Patent-3,625,084;
US-Patent-Appl-SN-73932; US-Patent-Class-74-501R) Avail: US Patent Office CSCL 13I

A flexible cable assembly is described that can be made rigid with selective tensioning. It is composed of elongated links with axial bore for the cable. At one end of each link are two parallel projections with serrations at their apex. At the other end of a link is a projecting tongue with serrated semicircular reliefs on either side. When assembled, the parallel projections of one end are engageable and journaled to the semicircular reliefs of the tongue. A spring between each link regulates the flexibility of the cable. Official Gazette of the U.S. Patent Office

N72-22486* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
UNIVERSAL ENVIRONMENT PACKAGE WITH SECTIONAL COMPONENT HOUSING Patent
Graydon A. Phlieger, Jr., inventor (to NASA) Issued 1 Feb. 1972 6 p Filed 16 Dec. 1970 Supersedes N72-15475 (10 - 06, P 0778)
(NASA-Case-KSC-10031; US-Patent-3,639,809;
US-Patent-Appl-SN-98773; US-Patent-Class-317-117;
US-Patent-Class-220-5R; US-Patent-Class-317-120;
US-Patent-Class-317-101DH) Avail: US Patent Office CSCL 13D

A housing is described that can be readily assembled for packaging equipment, such as electrical components and meters. The housing includes a pair of spaced end rings, each of which has an endless groove in the inner wall. A thin elongate shell is positioned within the groove and end plates are carried against ridges on the opposite side of the end rings. Bolts extend through the panels for drawing the panels flush against the ridges carried on the end ring and supporting panel boards within the housing. Thus, an airtight package or housing can be readily assembled from stocked packages.
Official Gazette of the U.S. Patent Office

N72-22487* Boeing Co., Seattle, Wash.
THERMAL COMPRESSION BONDING OF INTERCONNECTORS Patent
David R. Clarke, inventor (to NASA) Issued 16 Nov. 1971 7 p Filed 27 Feb. 1969 Sponsored by NASA
(NASA-Case-GSC-10303; US-Patent-3,619,896;
US-Patent-Appl-SN-802813; US-Patent-Class-29-473.1) Avail: US Patent Office CSCL 13H

A method and apparatus for diffusion bonding are described for joining dissimilar metals using heat and pressure in a vacuum chamber. Metal terminals are overlapped and clamped together in a vacuum; heat from 250 to 500 C, and pressure from 500 to 5000 psi are applied for an appropriate time. F.O.S.

N72-22488* North American Rockwell Corp., Downey, Calif.
FRANGIBLE LINK Patent
David W. Murphy, inventor (to NASA) Issued 30 Nov. 1971 5 p Filed 28 Jan. 1970 Supersedes N70-25675 (08 - 12, p 2214) Sponsored by NASA
(NASA-Case-MSC-11849-1; US-Patent-3,623,394;
US-Patent-Appl-SN-6617; US-Patent-Class-85-1) Avail: US Patent Office CSCL 13E

A frangible connecting link is described for securing together two separable structures such as two stages of a multistage missile. It consists of a threaded fastener having a through bore with female threads on each end of the bore. Explosive detonators are placed in each threaded end. Midway between the bores is a V-shaped trough cut about the bore periphery. A V-shaped trough is also cut around the outside periphery of the link with the apices of each trough being in radial alignment. An elastomer ring is molded into the internal trough and is of such shape as to provide a small cylindrical space between opposing faces of the respective detonators. Ignition of either detonator produces a gas pressure within the space exerting a tensile force between the trough apices via the elastomer ring, thereby causing structural failure along a single plane.
Official Gazette of the U.S. Patent Office

N72-22489* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TRAP FOR PREVENTING DIFFUSION PUMP BACKSTREAMING Patent
Harold Shapiro, inventor (to NASA) Issued 30 Nov. 1971 5 p Filed 31 Dec. 1968 Supersedes N69-21855 (07 - 10, p 1713)
(NASA-Case-GSC-10518-1; US-Patent-3,623,828;
US-Patent-Appl-SN-789045; US-Patent-Class-417-152;
US-Patent-Class-55-446; US-Patent-Class-55-464) Avail: US Patent Office CSCL 13K

An oil-backstreaming trap is described which is located in a vacuum line between an oil diffusion pump and the evacuated system so that gases from the system are drawn through the trap on the way to the pump. First and second baffle plates extend partially across the cross-sectional area of the trap and are spaced apart from each other along the direction of gas flow. The surface of the baffle plate closest to the evacuated system is smooth. The other baffle plate surfaces are roughened. Oil vapor from the diffusion pump which tends to backstream into the evacuated system is coalesced on the roughened surfaces to form oil drops which then fall back into the diffusion pump.
Official Gazette of the U.S. Patent Office

N72-22490* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH SPEED ROLLING ELEMENT BEARING Patent
William J. Anderson and Harold H. Coe, inventors (to NASA) Issued 16 Nov. 1971 6 p Filed 16 Jan. 1970 Supersedes N70-26816 (08 - 13, p 2390)
(NASA-Case-LEW-10856-1; US-Patent-3,620,585;
US-Patent-Appl-SN-3417; US-Patent-Class-308-195) Avail: US Patent Office CSCL 13I

A method is described for reducing the mass of ball bearings for reliable long life operation at high speeds. Mass reduction is achieved by machining holes in the ball bearings, and inserting a pin through the hole and the cage to restrict pivoting of the bearing. F.O.S.

N72-22491* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RESISTANCE SOLDERING APPARATUS Patent
Clara M. Vermillion, inventor (to NASA) Issued 16 Nov. 1971 5 p Filed 31 Dec. 1969 Supersedes N70-22206 (08 - 09, p 1641)
(NASA-Case-GSC-10913; US-Patent-3,621,194;
US-Patent-Appl-SN-889558; US-Patent-Class-219-234;
US-Patent-Class-29-628; US-Patent-Class-219-85;
US-Patent-Class-219-158; US-Patent-Class-228-57) Avail: US Patent Office CSCL 13I

The apparatus comprises a complementary connector block and a probe. The probe and the complementary connector block are connected to a suitable source of electric power. The

complementary connector block is the complement of the multiple-terminal block to which the leads are to be soldered. If the multiple terminal block is a male block, the complementary connector block is a corresponding female block and vice versa. All of the terminals of the complementary connector block are commonly connected to one side of said source of electric power and the probe is connected to the other side. Hence, when the tip of the probe is brought into contact with any of the solder cups or connecting tabs of the multiple-terminal block, current blows through that cup and generates sufficient heat for resistance soldering to take place.

Official Gazette of the U.S. Patent Office

N72-22492* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

BONDING OF REINFORCED TEFLON TO METALS Patent

Felix P. Lalacona, inventor (to NASA) Issued 7 Sep. 1971 5 p Filed 28 Jan. 1970 Supersedes N70-26806 (08 - 13, p 2390)

(NASA-Case-MFS-20482; US-Patent-3,602,979; US-Patent-Appl-SN-6610; US-Patent-Class-29-473.1; US-Patent-Class-29-472.9) Avail: NTIS CSCL 13H

Reinforced FEP Teflon composite material is bonded to a metal substrate by applying a thin layer of copper on the metal surface and disposing irregularly shaped copper particles on the coated surface. The reinforced Teflon is then assembled in contact with the particles, and the assembly is heated under pressure at an elevated temperature below the melting point of the Teflon. A diffusion bond stronger than the reinforced Teflon component is produced, thus enabling the fabrication of self-lubricating bodies with relatively high strength.

Official Gazette of the U.S. Patent Office

N72-22493*# Pratt and Whitney Aircraft, East Hartford, Conn.

EVALUATION OF DRILLED-BALL BEARINGS AT DN VALUES TO THREE MILLION. 1: VARIABLE OIL FLOW TESTS

P. W. Holmes Washington NASA Jul. 1932 59 p

(Contract NAS3-14417)

(NASA-CR-2004; PWA-4235) Avail: NTIS CSCL 13I

Two 125-mm-bore solid ball bearings and two similar drilled ball bearings were operated at speeds up to 24,000 rpm (3.0 million DN) with a 13,000 newton (3000 lb) thrust load. The oil flow rate was varied from 0.045 to 0.121 kilograms per second (6 to 16 lb/min). The solid ball bearings operated satisfactorily over the entire range of conditions. The drilled ball bearing experienced cage rub with marginal lubrication at 0.045 kilograms per second (6 lb/min). The drilled ball bearing generally ran cooler than the solid ball bearings. Author

N72-22494 + Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).

ULTRASONIC INSPECTION AND EXAMINATION OF CAST IRON LARGE SIZE FARREL CYLINDER

L. X. Nepomuceno 9 Nov. 1971 9 p refs In PORTUGUESE; ENGLISH summary

(TR-7111-545) Avail: NTIS

The report describes the equipment, accessories, and procedure used for the ultrasonic inspection and examination of a large size cast iron cylinder. The inspection covered the full outer surface; results are presented in schematic drawing form, with echogram indication of defects. Author

N72-22495# Aeronautical Research Labs., Melbourne (Australia).

ANALYSIS OF SAFE FATIGUE LIFE AND SAFE INSPECTION INTERVALS BY RELIABILITY AND CONVENTIONAL THEORY

F. H. Hooke Jul. 1971 15 p refs

(ARL/SM-335; ISBN-642-97706-2) Avail: NTIS

Both the conventional and reliability analyses for determining safe fatigue life are predicated on a population having a specified (usually log-normal) distribution of life-to-collapse under a fatigue test load. Under a random service load spectrum, random occurrences of load larger than the fatigue test load may confront and cause collapse of structures which are weakened, though not yet to the fatigue test load. These collapses are included in reliability but excluded in conventional analysis. The theory of risk determination by each method is given, and several reasonably typical examples were worked out, in which it transpires that if one excludes collapse through exceedance of the uncracked strength, the reliability and conventional analyses gave virtually identical probabilities of failure or survival. Author

N72-22496*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ADVANCED AIRBREATHING ENGINE LUBRICANTS STUDY WITH A TETRAESTER FLUID AND A SYNTHETIC PARAFFINIC OIL AT 492 K (425 F)

Erwin V. Zaretsky and Eric N. Bamberger (GE Co., Cincinnati, Ohio) Washington Apr. 1972 23 p refs

(NASA-TN-D-6771; E-6541) Avail: NTIS CSCL 11H

Groups of 120-mm-bore angular-contact ball bearings made from AISI M-50 steel were fatigue tested with a tetraester and a synthetic paraffinic oil at a bearing temperature of 492 K (425 F) in an air environment. Bearing life exceeded AFBMA-predicted (catalog) life by factors in excess of 4 and 10 for the tetraester and synthetic paraffinic fluids, respectively. The final viscosities after 500 hours of operation were 14 and 6 times the initial values, respectively. During the same time period, when the test oil is replaced at a rate approximating the replenishment rate in actual commerical engine usage, no significant increase in lubricant viscosity with time was observed. Author

N72-22497*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

INFLUENCE OF SILICON ON FRICTION AND WEAR OF IRON-COBALT ALLOYS

Donald H. Buckley and William A. Brainard Washington Apr. 1972 15 p refs

(NASA-TN-D-6769; E-6708) Avail: NTIS CSCL 11H

Sliding friction and wear experiments were conducted with ternary ordered alloys of iron and cobalt containing various amounts of silicon to 5 weight percent. The friction and wear of these alloys were compared to those for binary iron-cobalt alloys in the ordered and disordered states and to those for the conventionally used bearing material, 440-C. Environments in which experiments were conducted included air, argon, and 0.25 percent stearic acid in hexadecane. Results indicate that a ternary iron - cobalt - 5-percent-silicon alloy exhibits lower friction and wear than the simple binary iron-cobalt alloy. It exhibits lower wear than 440-C in all three environments. Friction was lower for the alloy in argon than in air. Auger analysis of the surface of the ternary alloy indicated segregation of silicon at the surface as a result of sliding. Author

N72-22498*# Martin Marietta Corp., Denver, Colo.

COMPOSITE OVERWRAPPED METALLIC TANKS Final Report, 28 Feb. 1970 - 17 Dec. 1971

C. L. Caudill and R. L. Kirlin Mar. 1972 138 p

(Contract NAS3-12023)

(NASA-CR-120888) Avail: NTIS CSCL 13H

Work is reported for fabricating and testing the fiberglass overwrapped titanium pressure vessel for cryogenic service. Difficulties encountered in the tank liner fabrication phase involved explosive forming, vacuum annealing, chemical milling and electron beam welding. While each of these processes and the nondestructive test methods employed are normally considered to be individually reliable, the combination of poor material together with fabrication and development reversals prevented the full achievement of the desired end results. Eight tanks plus a prototype and tool proofing article were produced. Six of the vessels failed during the hydrostatic sizing operation. One of the remaining tanks was hydrostatically pressurized to burst and the other was pressurized repeatedly at 75 F from 100 psi to the operating pressure until failure occurred. As a result, it is not

possible to draw firm conclusions as to the true value of the design concept due to the problems encountered in the program.
Author

N72-22499+ Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
ULTRASONIC INSPECTION OF HEAVY FORGED STEEL CYLINDERS
L. X. Nepomuceno, A. Sakamoto, and M. F. Barbosa 12 Apr. 1971 8 p refs In PORTUGUESE; ENGLISH summary
(Rept-7104.498) Avail: NTIS

The results of ultrasonic inspection of two steel cylinders are presented. The equipment, procedures, and specifications used in the inspection are described. Schematics and photographs of the defects are included. Transl. By F.O.S.

N72-22500*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESIGN STUDY OF SHAFT FACE SEAL WITH SELF-ACTING LIFT AUGMENTATION. 4: FORCE BALANCE
Lawrence P. Ludwig, John Zuk, and Robert L. Johnson Washington Apr. 1972 28 p refs
(NASA-TN-D-6568; E-6458) Avail: NTIS CSCL 11A

A method for predicting the operating film thickness of self-acting seals is described. The analysis considers a 16.76-cm mean diameter seal that is typical of large gas turbines for aircraft. Four design points were selected to cover a wide range of operation for advanced engines. This operating range covered sliding speeds of 61 to 153 m/sec, sealed pressures of 45 to 217 N/sq cm abs, and gas temperatures of 311 to 977 K. The force balance analysis revealed that the seal operated without contact over the operating range with gas film thicknesses ranging between 0.00046 to 0.00119 cm, and with gas leakage rates between 0.01 to 0.39 scmm. Author

N72-22501*# North American Rockwell Corp., Anaheim, Calif.
DEVELOPMENT OF NONDESTRUCTIVE TESTING TECHNIQUES FOR PLATED-THROUGH HOLES IN MULTILAYER PRINTED CIRCUIT BOARDS Final Report
Philip L. Anthony and James E. McMurtrey Dec. 1971 99 p
(Contract NAS8-25704)
(NASA-CR-61378; C71-995-201) Avail: NTIS CSCL 14D

The development of a nondestructive test with the capability to interrogate plated-through holes as small as 0.51 millimeters inside diameter is discussed. The system can detect defects such as holes, voids, cracks, and thin spots that reduce the current carrying capability of plates-through interconnects by 20 percent or more. Efforts were directed toward the design and fabrication of magnetic circuitry mutual coupling probes and to evaluate the effectiveness of these devices for detecting in multilayer board plated-through holes. Author

N72-22502*# Radiation, Inc., Melbourne, Fla. Systems Div.
STUDY OF TECHNIQUES FOR REDUNDANCY VERIFICATION WITHOUT DISRUPTING SYSTEMS, PHASES 1-3
Sep. 1970 270 p
(Contract NAS10-7072)
(NASA-CR-126152) Avail: NTIS CSCL 14D

The problem of verifying the operational integrity of redundant equipment and the impact of a requirement for verification on such equipment are considered. Redundant circuits are examined and the characteristics which determine adaptability to verification are identified. Mutually exclusive and exhaustive categories for verification approaches are established. The range of applicability of these techniques is defined in terms of signal characteristics and redundancy features. Verification approaches are discussed and a methodology for the design of redundancy verification is developed. A case study is presented which involves the design of a verification system for a hypothetical communications system. Design criteria for redundant equipment are presented. Recommendations for the development of technological areas pertinent to the goal of increased verification capabilities are given. Author

N72-22503*# Pratt and Whitney Aircraft, East Hartford, Conn.
EVALUATION OF DRILLED-BALL BEARINGS AT DN VALUES TO THREE MILLION. 2: EXPERIMENTAL SKID STUDY AND ENDURANCE TESTS
P. W. Holmes Washington NASA Apr. 1972 110 p
(Contract NAS3-14417)
(NASA-CR-2005; PWA-4325) Avail: NTIS CSCL 13I

Both drilled-and solid-ball 120-mm-bore bearings were tested at speeds up to 24,000 rpm to determine skid characteristics. The thrust loads were varied from 5000 lb down to 370 lb. No gross skidding occurred, and the behavior of the two bearing types was generally similar; however, two drilled-ball bearing failures occurred during the skid tests. In the endurance tests, 25 cycles of start, run (for one hour), and stop were completed before a drilled-ball bearing failed. In all three cases, the ball had failed in flexure fatigue. Author

N72-22504*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STABILITY OF WATER-LUBRICATED THREE-LOBE JOURNALS MATED WITH PLAIN BEARINGS AT ZERO LOAD
Fredrick T. Schuller Washington Apr. 1972 23 p refs
(NASA-TN-D-6796; E-6710) Avail: NTIS CSCL 13I

Tests were conducted with plain bearings running with three types of three-lobe journals. The bearings, with a nominal 3.8-centimeter (1.5-in.) diameter and L/D of 1, were tested at 300 K (80 F) under stable conditions to 5400 rpm. The lobed configurations tested, in order of diminishing stability, were a tilted-lobe journal with grooves, a tilted-lobe journal without grooves, and a centrally lobed journal without grooves. A previously tested three-tilted-lobe bearing with grooves, running with a plain journal, was somewhat more stable than the tilted-lobe or centrally lobed journals. Author

N72-22505*# Army Dept., Washington, D.C.
MOLDING PROCESS FOR IMIDAZOPYRROLONE POLYMERS Patent Application
Charles L. Johnson, inventor (to NASA) Filed 29 Oct. 1971 8 p Sponsored by NASA
(NASA-Case-LAR-10547-1; US-Patent-Appl-SN-193980) Avail: NTIS CSCL 13H

A process is described for producing shaped articles of imidazopyrrolone polymers, comprising molding imidazopyrrolone polymer molding powder under pressure and at a temperature greater than 475 C. Moderate pressure may be employed. Preferably, prior to molding, a preform is prepared by isostatic compression. The preform may be molded at a relatively low initial pressure and temperature; as the temperature is increased to a value greater than 475 C, the pressure is also increased.
NASA

N72-22506# SKF Industries, Inc., King of Prussia, Pa. Research Lab.
DEVELOPMENT OF HIGH TEMPERATURE ROLLING BEARINGS FOR OPERATION IN LIQUID SODIUM Quarterly Progress Report, 1 Jul. - 30 Sep. 1971
W. E. Jamison 30 Sep. 1971 19 p refs
(Contract AT(11-1)-3061)
(AL71T071; NYO-4117-6; QPR-5) Avail: NTIS

Results of tests of candidate materials in high-temperature Na are presented. Descriptions and discussions of tests on Rex 49 flat washers and rollers, and TZM cages at 800 F under loads of 182 kg are included along with information on fabrication of test specimens. NSA

N72-22507# Reactor Centrum Nederland, Petten.
NEUTRON RADIOGRAPHY: A SUMMARY OF PRINCIPLES AND POSSIBILITIES
P. J. Demunk May 1971 32 p refs
(RCN-138) Avail: AEC Depository Libraries

The theory and practice of neutron radiography is described.

Attention is paid to that technique by which radiographs of radioactive materials can be made. This technique is called the transfer method which uses an intermediate radioactive foil to produce an image on a photographic film. Neutron radiography is proposed to be applied as a nondestructive inspection method especially for the examination of irradiated fuel, although other experiments may benefit by using this inspection technique. A few experiments were and are being conducted in a beam tube of the Low Flux Reactor. The aim of these experiments is to provide data for the apparatus that will be installed in the HFR.
NSA

N72-22508# Biospherics, Inc., Rockville, Md.
AUTOMATED PRIMARY PRODUCTIVITY MEASUREMENTS IN WATER BODIES. PHASE 2: DESIGN, FABRICATION AND TEST OF DEMONSTRATION INSTRUMENT
William A. Lindgren, Edward Rich, Jr., Donald G. Shaheen, and Gilbert V. Levin 1971 274 p refs
(Contract AT(30-1)-3993)
(NYO-3993-2) Avail: NTIS

An automated instrument to make continual measurements of aquatic primary productivity by the radiocarbon method is described. The instrument, based on the light and dark bottle technique, permits oceanographers, limnologists, and pollution control workers to make greater use than hitherto possible of this fundamental ecological parameter. Automatic programming of the procedure will standardize the assay, improving the comparability of data among different investigators. Another significant advantage of the instrument is that it conducts the assay in situ as opposed to the manual technique which requires that the sample be brought to the surface where it is exposed to physical and chemical changes which introduce error into the results. An Engineering Test Model of the Automated Primary Productivity Instrument has been designed, fabricated, and tested.
Author

N72-22509# Army Foreign Science and Technology Center, Charlottesville, Va.
BELT CONVEYORS ON AIR CUSHION
P. Onoklov and Yu. Makhover 29 Oct. 1971 8 p Transl. into ENGLISH from Rechnoi Transport (USSR), v. 28, no. 5, 1969
(AD-736546; FSTC-HT-23-400-71) Avail: NTIS CSCL 13/9

Analysis of suggested conveyor systems and the designs of apparatus using air cushions resulted in the development of a classification of possible methods of air support of belts, based on the method of feeding the air beneath the belt. Tests of experimental conveyors with belts moving on air cushion (lubrication) confirmed their workability and the correctness of the principles upon which they are based.
Author (GRA)

N72-22510# Stanford Research Inst., Menlo Park, Calif.
MATERIALS PROCESSING OF RARE EARTH-COBALT PERMANENT MAGNETS Semiannual Technical Interim Report, 1 Jan. - 30 Jun. 1971
Paul J. Jorgensen and Robert W. Bartlett Wright-Patterson AFB, Ohio AFML Aug. 1971 69 p refs
(Contract F33615-70-C-1624; ARPA Order-1617)
(AD-736480; AFML-TR-71-188; SATR-2) Avail: NTIS CSCL 09/1

Rare earth-cobalt intermetallic compounds show promise for permanent magnets with a higher energy product than are currently available. Because fine particles are required for magnetic alignment and sintering, and since the coercivities of these fine particles are sensitive to overgrinding and particle surface preparation, various powder preparation techniques were investigated as alternative methods for producing strain-free particles. Methods that were investigated include plasma spheroidization, plasma annealing, electrodeposition in fused salts, electrodeposition in organic liquids, direct reduction from amalgam droplets, precipitation from liquid zinc alloy solutions and direct metallothermic reduction.
Author (GRA)

N72-22511# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
TITANIUM POWER METALLURGY FORGINGS Final Technical Report, 15 Mar. 1968 - 30 Jun. 1971
Roger E. Peebles Wright-Patterson AFB, Ohio AFML Sep. 1971 284 p refs
(Contract F33615-68-C-1356; AF Proj. 183-3)
(AD-736477; Rept-71-AEG295; AFML-TR-71-148) Avail: NTIS CSCL 13/8

The objective of the contract effort was to ascertain the processing sequences and methods needed to produce precision forged structural and jet engine components from metal powder preforms of titanium alloys. This objective was attained in that an economical powder production process (Hydride-Dehydride) was identified. A technique isostatic pressing followed by high temperature vacuum sintering was identified and a procedure established to consolidate the powders into complex forging preforms and configurations at about 85 to 90% theoretical density. The forging sequence to density these preforms to 100% theoretical density was established.
Author (GRA)

N72-22512# Aerospace Corp., El Segundo, Calif.
TEXTURE STRENGTHENING OF SPIN-FORGED Ti-6Al-4V ALLOY Research Report, Sep. 1969 - Jan. 1970
Maurice F. Amateau 15 Jan. 1972 26 p refs
(Contract F04701-71-C-0172)
(AD-736445; TR-0172(2250-10)-5; SAMSO-TR-72-8) Avail: NTIS CSCL 13/8

Ti-6Al-4V plates were spin-forged into hemispheres so that the effect of the spinning process on plastic strain anisotropy could be examined. Spinning temperatures were varied from 400 to 1725F, and plastic strains in the longitudinal and transverse directions were measured. The plastic strain anistropy and texture developed by spin-forging were similar to those produced by other forms of processing and resulted in texture strengthening at low spinning temperatures.
Author (GRA)

N72-22513# Air Force Systems Command, Wright-Patterson AFB, Ohio.
EXPERIMENTAL DETERMINATION OF THE COEFFICIENT OF FRICTION DURING THE CONTACT OF A SPHERE WITH A CONE
O. V. Rumyantsevov, V. D. Prodan, and F. F. Pershin 11 Nov. 1971 9 p refs Transl. into ENGLISH from Mashinovedenie (USSR), no. 4, 1970 p 101-103
(AD-736400; FTD-HT-23-1374-71) Avail: NTIS CSCL 11/1

It is shown that a common type of valve sealing results from the high contact stresses provided when a spherical shape is forced into a conical depression. This work is dedicated to determination of the coefficient of friction in the area of relatively high specific pressures upon contact between a sphere and a cone. In the experimental study performed, the sphere was replaced by a device with three legs extending at even intervals around a circle from a cylindrical center section. The ends of the legs were worked into a spherical shape with a radus of 50 mm (replacement of the sphere with a rod model allowed the authors to study the planar problem).
Author (GRA)

N72-22514# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A METHOD TO DETERMINE THE FISSURING OF ALUMINUM WELDING JOINTS
Sever Sontea 6 Dec. 1971 16 p refs Transl. into ENGLISH from Constructia de Masini (Rumania), v. 21, no. 12, 1969 p 749-752
(AD-736396; FTD-HC-23-816-17) Avail: NTIS CSCL 13/8

The present stage of fissuring experiments on aluminum welding joints is described, and a method which utilizes the ultrasonic waves to control the determinations is suggested. This was accomplished with the help of an ultrasonic fault detector. The method furnishes supplementary data regarding the way the welding fails under conditions that could occur under exaggerated stresses during use.
GRA

N72-22515# Battelle Memorial Inst., Columbus, Ohio. Metals and Ceramics Information Center.
SHOT PEENING FOR IMPROVED FATIGUE PROPERTIES AND STRESS-CORROSION RESISTANCE
J. E. Campbell Dec. 1971 54 p refs Sponsored by Defense Supply Agency
(AD-735409; MCIC-71-02) Avail: NTIS CSCL 13/8

Shot peening procedures developed over the past 40 years have resulted in substantial improvements in fatigue properties and stress corrosion resistance of high-strength alloys. These improvements have been observed in shot-peened specimens and components of high-strength steels, aluminum alloys, titanium alloys, and other engineering alloys. This report contains information on peening procedures that have been used in processing specimens and components to achieve these improvements in performance. Certain precautions are pointed out that should be observed in order to obtain the improved properties that have been attributed to the peening process. Some of the peening programs cited in this report indicate the peening intensities that resulted in the greatest benefit in performance based on test data covering a range of intensities, shot sizes, and other variables. Author (GRA)

N72-22304*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
CHANGES IN SOME PHYSICAL PROPERTIES INDUCED BY VACUUM HEAT TREATMENT
A. E. Hultquist *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 875-879 ref (See N72-22250 13-11)
(Paper-76) Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 13H

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N72-22516# Institut Franco-Allemand de Recherches, St. Louis (France).
HOLOGRAPHY OF LARGE SIZED OBJECTS IN MOTION [HOLOGRAPHIE DES OBJETS DE GRANDES DIMENSIONS EN MOUVEMENT]
A. Hirth and K. Vollrath 19 Aug. 1971 38 p refs In FRENCH
(Contract T/0260/12630/11006)
(ISL-RT-13/71) Avail: NTIS

Experiments were conducted in holographic interferometry by double exposure with time intervals of 80 to 160 microseconds between exposures. Results indicate that the two impulses correspond to two different axial modes (at a frequency interval of about 5 GHz). It appears that a system of interference fringes most often masks the phenomenon being studied. An apparatus is proposed which permits a frequency separation between the two impulses of less than 500 MHz. Transl. by K.P.D.

N72-22517*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
APPLICATIONS ANALYSIS OF HIGH ENERGY LASERS
R. D. Arno, J. S. MacKay, and K. Nishioka Mar. 1972 66 p refs
(NASA-TM-X-62142) Avail: NTIS CSCL 20E

An analysis and comparison of laser technology with competing technologies were made to determine possible laser applications. The analysis was undertaken as follows: (1) possible applications were listed and categorized; (2) required components were enumerated and the characteristics of these components were extrapolated; (3) complete system characteristics were calculated parametrically for selected applications using the postulated component characteristics; and (4) where possible and appropriate, comparisons were made with competing systems. It was found that any large scale replacement of existing systems and methods by lasers requires many technological advances in laser and associated systems. However, several applications appear feasible, such as low orbit drag make-up, orbit changing, communications, and illumination applications. F.O.S.

N72-22518# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
HOLOGRAPHIC INTERFEROMETRY BENCH
Jean Surget 1971 25 p refs In FRENCH; ENGLISH summary Presented at 9th Intern. Colloq. of Ind. Control, Paris, 29 Nov. - 3 Dec. 1971
(ONERA-TP-1037) Avail: NTIS

The respective principles of conventional and holographic interferotry are first briefly recalled. The advantages of the latter are underlined, and illustrated by results obtained at ONERA in the field of stress analysis and for studying aerodynamic flows. Author

N72-22519*# Maryland Univ., College Park. Dept. of Physics and Astronomy
SUB-NANOSECOND RANGING POSSIBILITIES OF OPTICAL RADAR AT VARIOUS SIGNAL LEVELS AND TRANSMITTED PULSE WIDTHS Final Report
Sherman K. Poultney 30 Dec. 1971 37 p refs
(Grant NGR-21-002-211)
(NASA-CR-122378; TR-72-075) Avail: NTIS CSCL 20E

The behavior of the photomultiplier is considered, as well as the method of derivation of the photomultiplier output pulse and its relation to the reflected light pulse width and amplitude, and the calibration of range precision and accuracy. Pulsed laser radars with light pulse widths of 30, 3, and 0.1 nanosec a considered, with the 0.1 nanosec system capable of highest precision in several modes of operation, including a high repetition rate, single photoelectron reception mode. An alternate calibration scheme using a fast, triggerable light pulser is described in detail. Author

N72-22520*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A TECHNIQUE FOR BREAKING ICE IN THE PATH OF A SHIP Patent Application
Andrew R. Saunders, Robert V. Hess, and Roy A. Lucht, inventors (to NASA) Filed 10 Mar. 1972 11 p
(NASA-Case-LAR-10815-1; US-Patent-Appl-SN-233587) Avail: NTIS CSCL 20E

A technique is described for breaking ice in the path of a ship. A laser is placed on the bow of the ship with apparatus to scan the ice in the path of the ship with the laser beam. The beam cuts or shatters the ice, enabling the ship to break the ice in its path. NASA

N72-22521# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Flugfunk und Mikrowellen Oberpfaffenhofen.
CALCULATIONS OF THE RATE EQUATIONS FOR A Q-SWITCH LASER WITH RESPECT TO THE STANDING WAVE
F. Malota 1971 20 p refs In GERMAN; ENGLISH summary
(DLR-Mitt-71-25) Avail: NTIS; DFVLR, Porz-Wahn: 8,40 DM

Rate equations for a Q-switch laser under consideration of the sinusoidal variation of the electromagnetic field in the cavity are presented. These rate equations are calculated numerically and compared with the results of the rate equations where no sinusoidal dependency was supposed. When making the calculations, it appeared that the present formulation can be used on distribution of inversion within the range eta sub zero = 0.4 to 0.8. Author

N72-22522# California Univ., Livermore. Lawrence Radiation Lab.
SOME ASPECTS OF CONTROLLED FUSION BY USE OF

LASERS
Ray E. Kidder 25 Oct. 1971 20 p refs Presented at Symp. on Fundamental and Appl. Laser Phys., Isfahan, Iran, 29 Aug. - 5 Sep. 1971
(UCRL-73500; Conf-710826-1) Avail: NTIS

The application of lasers to controlled fusion is considered, particular attention being given to fusion reactors based on laser-heated DT pellets. The requirements a laser must meet to be useful for this purpose are discussed. A decoupling effect resulting from the fact that long-wavelength light can only penetrate and heat plasma electrons at relatively low density is described, which suggests that light of wavelength as great as ten microns may not be suitable for pellet heating.
Author (NSA)

N72-22523# European Space Research Inst., Frascati (Italy).
A DYE LASER FORCED OSCILLATOR
G. Magyar and H.-J. Schneider-Muntau [1972] 11 p refs Submitted for publication
Avail: NTIS

The narrow band output of a small, flashlamp pumped, coaxial dye laser is injected internally into a large close coupled oscillator. When frequency locked, an effective power gain of approximately 4000 and an energy output of approximately 600 mJ in a width of approximately 0.01 nm is achieved.
Author (ESRO)

N72-22524# Technische Univ., Berlin (West Germany). Inst. fuer Flugfuehrung und Luftverkehr.
EXPERIMENTAL AND THEORETICAL INVESTIGATIONS OF THE USE OF LASERS FOR SOLVING MEASURING AND PRECISION ENGINEERING PROBLEMS CONCERNING INERTIAL GUIDANCE AND NAVIGATION [EXPERIMENTELLE UND THEORETISCHE UNTERSUCHUNGEN UEBER DEN EINSATZ VON LASERN ZUR LOESUNG VON MESS- UND FEINWERKTECHNISCHEN PROBLEMEN DER INERTIALEN LENK- UND NAVIGATIONSTECHNIK]
W. Holzapfel 1971 202 p refs In GERMAN
(Rept-59) Avail: NTIS

The application of lasers to rotary gyroscope vibration analysis, gyroscope balancing, and gravimetric accelerometers is investigated. A laser interferometric method is described for the precise determination of the amplitude and phase of flywheel vibrations. In addition, the rotary and translatory vibration of the gyroscope due to dynamic or static unbalance is identified. Methods for the balancing of gyroscopes during rotation using material eroding pulsed laser radiation are discussed. The concept and properties of a sensitive acceleration measuring instrument, based on gravimetric principles and using laser techniques, are discussed.
ESRO

N72-22525# Army Foreign Science and Technology Center, Charlottesville, Va.
ELECTROOPTICAL PULSE-PHASE GDFI-1 RANGE FINDER WITH SEMICONDUCTOR OUTPUT UNIT
V. N. Deryagin and S. V. Berkalov 20 Oct. 1971 9 p refs Transl. into ENGLISH from Opt.-Mekh. Prom. (Leningrad), v. 37, no. 6, 1970 p 27-29
(AD-736002; FSTC-HT-23-817-71) Avail: NTIS CSCL 17/5

A Pulse-Phase Gallium Arsenide (Laser) Range Finder is described.
Author (GRA)

N72-22526# American Optical Co., Southbridge, Mass. Central Research Lab.
NEODYMIUM LASER GLASS IMPROVEMENT PROGRAM Technical Summary Report, 1 Jul. - 31 Dec. 1966
Richard F. Woodcock Dec. 1971 10 p
(Contract Nonr-3835(00); ARPA Order 306)
(AD-736214; TR-598-9; TSR-9) Avail: NTIS CSCL 20/5

Determination of the thermal coefficient of refractive index was begun on the second generation of a thermal glass composition, and results are encouraging. The procedure for measuring stress-optical coefficients was reviewed and a more refined technique for applying pressure to the sample is under investigation. Improvements in glass quality required for some of the property measurements have been obtained.
Author (GRA)

N72-22527# Aerospace Corp., El Segundo, Calif. Lab. Operations.
EFFECT OF O2 ON THE CO LASER PERFORMANCE Technical Report, Jan. - Dec. 1970
Thomas S. Hartwick and Jules Walder 15 Dec. 1971 14 p refs
(Contract F04701-71-C-0172)
(AD-736434; TR-0172(9230-10)-8; SAMSO-TR-71-330) Avail: NTIS CSCL 20/5

As the O2 concentration is increased from zero, the CO laser output power rises to a maximum and declines. This variation is correlated to a decrease in gas discharge kinetic temperature to a minimum followed by an increase for the same variation in O2 concentration.
Author (GRA)

N72-22528# Minnesota Univ., Minneapolis. Dept. of Electrical Engineering.
INFRARED DETECTORS, LASER TECHNOLOGY AND SIGNAL PROCESSING Annual Report, 1 Sep. 1970 - 30 Aug. 1971
R. J. Collins Sep. 1971 84 p refs
(Contract N00014-68-A-0141-0002)
(AD-736589; AR-4) Avail: NTIS CSCL 20/5

The report contains the following: Results of investigations of the gain in CO2 lasers; Holographic storage in ZnO; He-Cd ring laser, Photomixing at 10.6 micrometers; and, Photoelectric detector technology.
Author (GRA)

N72-22529# Owens-Illinois, Inc., Toledo, Ohio. Consumer and Technical Products Div.
DAMAGE THRESHOLD STUDIES OF GAS LASER MATERIALS Semiannual Technical Report
N. L. Boling, L. Spanoudis, and P. R. Wengart 31 Dec. 1971 42 p refs
(Contract DAHC15-69-C-0303; ARPA Order 1441)
(AD-736998) Avail: NTIS CSCL 20/5

The document discusses progress in the following area: development of a method for preventing the formation of damaging platinum particles in laser glass melted in platinum crucibles, the design and construction of a high energy density glass laser operating in the tem (OO) mode, and research on increasing the surface damage threshold of laser glass.
Author (GRA)

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N72-22530* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRODUCTION OF METAL POWDERS Patent
Alan Arias, inventor (to NASA) Issued 30 Nov. 1971 5 p Filed 28 Aug. 1969
(NASA-Case-XLE-06461; US-Patent-3,623,861; US-Patent-Appl-SN-853855; US-Patent-Class-75-5B) Avail: US Patent Office CSCL 11F

A method is described for producing metal powders of controlled particle size by reducing oxide using reactive metal vapor in a vacuum. Pieces of reactive metal are interposed

between spaced layers of powered oxides of the metal to be produced in an evacuated chamber. The chamber is heated to evaporate the reactive metal, and heating is continued until all the oxide has reacted with the reactive metal. The oxide of the reactive metal is removed by leaching. F.O.S.

N72-22531 National Lending Library for Science and Technology, Boston Spa (England).
CONNECTION BETWEEN CRITICAL CONCENTRATIONS AND THE SOLUBILITY LIMIT ACCORDING TO A MODEL OF SPHERES OF INTERACTION
E. S. Filippov [1971] 10 p refs Transl. into ENGLISH from Izv. Vuz (USSR), no. 9, 1971 p 108-113
(NLL-M-21252-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Experimental determination of the characteristics of droplets of a molten alloy revealed four special points on the property-composition curves for the Ag-Cu, Cu-Ni, Ni-Si, and Ni-Cr systems. The points are related to the critical concentrations and to the limiting solubility concentrations. The concentration relationships are explained from a model of spheres of interaction by the deformation of the spheres. Author

N72-22532 National Lending Library for Science and Technology, Boston Spa (England).
DETERMINATION OF THE PLASTICITY OF THE METAL FROM THE CENTRE CASTING GATE
S. Z. Yudovich and A. V. Sypko [1971] 4 p Transl. into ENGLISH from Izv. Vysshikh. Uchebn. Zavedenii, Chernaya Met. (Moscow), no. 9, 1971 p 142-143
(NLL-M-21255-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The possibility was examined of finding the plasticity of a cast metal from the center gate. The 20Kh15N3MA steel was used in the sprue, typifying the ingot metal, and it can also be used to find the optimum temperature regime for heating the metal before hot pressing. It is best to use the lower 2/3 of the gate with the densest possible macrostructure and without shrinkage cracks. Author

N72-22533 National Lending Library for Science and Technology, Boston Spa (England).
PRODUCTION OF NICKEL-BASE METALS CONTAINING CALCIUM OXIDE
V. P. Elyutin, E. I. Mozzhukhin, and Yu. A. Reznikov [1971] 8 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (USSR), no. 9, 1971 p 104-107
(NLL-M-21251-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The possibility and advisability of using dispersed inclusions of calcium oxide as the strengthening phase in nickel-based metal was demonstrated from thermodynamic calculations, allowing for the interaction between oxide inclusions and the metallic base. Experimental data are given for the effects of CaO content on the process of powdered nickel production. Inclusions of CaO have an effect similar to that of A1203 inclusions.
Author

N72-22534 National Lending Library for Science and Technology, Boston Spa (England).
EFFECT OF VOLUME CHANGES IN THE DIFFUSION REACTION PROCESS OF IRON AND ALUMINUM
A. K. Kurakin [1971] 5 p refs Transl. into ENGLISH from Fiz. Metal. i Metalloved. (USSR), v. 30, no. 2, 1970 p 432-433 In ENGLISH and RUSSIAN
(NLL-M-20958-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The volume changes occurring with the formation of an interstitial layer between Armco iron and aluminum are investigated. The changes take place in a steady state during the diffusion reaction. Inert markers were used to determine the course of diffusion. The diffusion of aluminum and iron proceeds reciprocally with an apparent preferred movement of iron atoms into aluminum. In carrying out tests after annealing samples, scaling of an aluminum layer from the chemical compound was observed. The diffusion of aluminum containing silicon and iron also proceeds reciprocally, but with an apparent movement of aluminum atoms into iron. After annealing samples of the bimetal, scaling of an aluminum layer from the chemical compound was not observed. It was concluded that the differing characters of the course of the diffusion processes determine the nature of the combination of the metals. Author

N72-22535* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NICKEL BAS ALLOY Patent
John C. Frenche and William J. Waters, inventors (to NASA) Issued 16 Nov. 1971 4 p Filed 28 Aug. 1970 Supersedes N71-28972 (09 - 16, p 2615)
(NASA-Case-LEW-10874-1; US-Patent-3,620,718; US-Patent-Appl-SN-68024; US-Patent-Class-75-170; US-Patent-Class-148-32.5) Avail: US Patent Office CSCL 11F

Nickel base alloys containing tungsten, aluminum, zirconium, and carbon in perferred weight percentage ranges have superior strength in the 2000 to 2200 F temperature range. This alloy has a nominal composition of 20% tungsten, 6.5% aluminum, 1% zirconium, 0.2% carbon, and the balance nickel. Official Gazette of the U.S. Patent Office

N72-22536*# Battelle Memorial Inst., Columbus, Ohio.
THE EFFECT OF ALLOY COMPOSITION ON THE MECHANISM OF STRESS CORROSION CRACKING OF TITANIUM ALLOYS IN AQUEOUS ENVIRONMENTS
Quarterly Progress Report, 11 Sep. - 11 Dec. 1971
J. D. Boyd, D. N. Williams, R. A. Wood, and R. I. Jaffee Feb. 1972 22 p refs
(Contract NASw-2242)
(NASA-CR-126217; QPR-2) Avail: NTIS CSCL 11F

The effects of alloy composition on the aqueous stress corrosion of titanium alloys were studied with emphasis on determining the interrelations among composition, phase structure, and deformation and fracture properties of the alpha phase in alpha-beta alloys. Accomplishments summarized include the effects of alloy composition on susceptibility, and metallurgical mechanisms of stress-corrosion cracking. F.O.S.

N72-22537*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN ELECTROCHEMICAL MODEL FOR HOT-SALT STRESS-CORROSION OF TITANIUM ALLOYS
Marvin Garfinkle Washington Apr. 1972 38 p refs
(NASA-TN-D-6779; E-6456) Avail: NTIS CSCL 11F

An electrochemical model of hot-salt stress-corrosion cracking of titanium alloys is proposed based on an oxygen-concentration cell. Hydrogen embrittlement is proposed as the direct cause of cracking, the hydrogen being generated as the results of the hydrolysis of complex halides formed at the shielded anode of the electrochemical cell. The model found to be consistent with the diverse observations made both in this study and by many investigators in this field. Author

N72-22538# Joint Publications Research Service, Arlington, Va.
MAGNESIOTHERMIC PRODUCTION OF SPONGE TITANIUM
V. V. Rodyakin, V. E. Geger, and V. M. Skrypnyuk 31 Mar. 1972 135 p refs Transl. into ENGLISH from the book "Magniyetermicheskoye Proizvodstvo Gubchatogo Titana" Moscow, Metallurgy Publishing House, 1971 p 5-13, 19-45, 87-112, 117-213
(JPRS-55596) Avail: NTIS

Excerpts are presented from a theoretical and practical handbook for production engineering personnel on the magnesiothermic production of titanium. Among the topics discussed are: (1) the preparation of titanium tetrachloride for

reduction, (2) the theoretical principles of reducing titanium using magnesium and vacuum separation of the reaction mass, (3) equipment for the production of sponge titanium, (4) production technology, and (5) methods of production improvement. K.P.D.

N72-22539*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FUNDAMENTAL MECHANISMS OF TENSILE FRACTURE IN ALUMINUM SHEET UNDIRECTIONALLY REINFORCED BORON FILAMENT
Harvey W. Herring Washington Apr. 1972 80 p refs
(NASA-TR-R-383; L-8137) Avail: NTIS CSCL 11F

Results are presented from an experimental study of the tensile-fracture process in aluminum sheet unidirectionally reinforced with boron filament. The tensile strength of the material is severely limited by a noncumulative fracture mechanism which involves the initiation and sustenance of a chain reaction of filament fractures at a relatively low stress level. Matrix fracture follows in a completely ductile manner. The minimum filament stress for initiation of the fracture mechanism is shown to be approximately 1.17 GN/sq m (170 ksi), and appears to be independent of filament diameter, number of filament layers, and the strength of the filament-matrix bond. All the commonly observed features of tensile fracture surfaces are explained in terms of the observed noncumulative fracture mechanism.
Author

N72-22540*# Translation Consultants, Ltd., Arlington, Va.
INVESTIGATIONS OF HARDENING AND OF CHANGE IN MICROSTRUCTURE
D. I. Shetulov, L. D. Sokolov, M. B. Magidov, A. M. Myasnikov, and V. V. Shibarov Washington NASA Apr. 1972 8 p refs Transl. into ENGLISH from Tr. Gorkovsk. Politekhn. Inst. (Gorki), v. 26, no. 8, 1970 p 8-12
(Contract NASw-2038)
(NASA-TT-F-14271) Avail: NTIS CSCL 11F

The effect of fatigue on the hardening of commercially pure Al, Cd, Zn, Cu, Fe, and Ti, and the role of packing defect energy, are discussed.
Author

N72-22541# Scientific Translation Service, Ann Arbor, Mich.
MORPHOLOGICAL CHANGES OF METAL TIPS BY HEAT TREATMENT (VERIFICATION OF THE NICHOLS AND MULLINS THEORY)
Vu Thien Binh, A. Piquet, H. Roux, R. Uzan, and M. Drechsler 27 Jul. 1970 8 p refs Transl. into ENGLISH from Surface Sci. (Amsterdam), no. 25, 1971 p 348-356 Prepared for AEC, Washington, D. C.
(AEC-tr-7286) Avail: NTIS

The morphological evolution of conical tungsten tips of cone angles between 1 and 15 deg at temperatures between 1800 and 3000 K was studied inside a scanning electron microscope. The experimental results confirm the theory of Nichols and Mullins concerning the existence of a critical cone angle alpha = 3 deg, formation of solid drops for alpha < 3 deg, and formation of characteristic steady-state shapes for alpha > 3 deg. For a temperature in the order of 2900 K (clean surface) the curvature radius at the tip apex increases with time according to the t(1/4) law. For temperatures below 2700 K discrepancies were found, which are due to an evaporation of tungsten compounds produced at the surface by a chemical reaction with the residual gas (0.00001 torr). The measurements at 2900 K enabled the determination of the surface diffusion coefficient of tungsten.
Author (NSA)

N72-22542# Maryland Univ., College Park. Dept. of Chemical Engineering.
INVESTIGATION OF IRRADIATION STRENGTHENING OF bcc METALS AND SOLID SOLUTIONS Progress Report, Jan. - Oct. 1971
R. J. Arsenault Oct. 1971 115 p refs
(Contract AT(40-1)-3612)
(ORO-3612-8) Avail: NTIS

Research results are presented on effects of irradiation damage on the low temperature deformation characteristics of bcc metals, low temperature deformation of V-Ti alloys, fracture behavior of V-1.31 at. % Ti alloys, scavenging in V-Ti alloys, effects of O on relaxation strength of V, and effects of short range barriers on dislocation.
NSA

N72-22543# Florida Univ., Gainesville. Dept. of Metallurgical and Materials Engineering.
INVESTIGATION OF ANOMALOUS WORK HARDENING AND DYNAMIC RECOVERY IN TITANIUM AND ZIRCONIUM Progress Report
15 Aug. 1971 33 p refs
(Contract AT(40-1)-3262)
(ORO-3262-23) Avail: NTIS

Research is reported on tests of Ti involving relations associated with the Cottrell-Stokes law, the effects of purity on strain rate sensitivity of Ti, effects of twinning on stress-strain curves for Zr, serrated yielding of Ti, theory of relaxation in Zr and Ti, effects of twinning on deformation in Zr, ductility of Zr, damping capacity of Zr, load carrying capacity of hexagonal metals, slip modes in Zr, interactions of twinning and slip in Zr, strain anisotropy in Ti, strain rate changes on stress-strain curves for Ti, tensile properties of Zr, and polycrystalline deformation study techniques.
NSA

N72-22544# California Univ., Los Angeles. Dept. of Materials.
VANADIUM ALLOY DEVELOPMENT Quarterly Progress Report, period ending 30 Jun. 1971
A. S. Tetelman, A. J. Ardell, and K. Ono Aug. 1971 13 p refs
(Contract AT(04-3)-34)
(UCLA-34-P-177-7) Avail: NTIS

Results of research on strengthening of vanadium alloys, work on structure and strengthening of Croloy, and precipitation reactions in stainless steel are discussed.
NSA

N72-22545# Sandia Labs., Albuquerque, N.Mex.
STRESS CORROSION CRACKING BEHAVIOR OF TUNGSTEN FILAMENT REINFORCED U-4 1/2 WT PERCENT Nb
N. J. Magnani, Herman Romero, and C. J. Miglionico Nov. 1971 15 p refs Sponsored by AEC
(SC-DR-710799) Avail: NTIS

The stress corrosion cracking behavior of tungsten reinforced U-4 1/2 wt% Nb was studied in 100% relative humidity air, specimens containing 0, 17, 38, and 51 volume percent tungsten fibers were used in the investigation. The tungsten fibers were perpendicular to a EDM machined precrack. The data show that as the tungsten content increases, the susceptibility to stress corrosion cracking decreases to the point where the 51% composite is only slightly susceptible. Fractographic analysis of the specimens indicates that not all of the fibers are equally effective in reinforcing the matrix.
Author (NSA)

N72-22546# Atomic Energy of Canada, Ltd., Pinawa (Manitoba). Whiteshell Nuclear Research Establishment.
FACTORS AFFECTING THE STRENGTH OF SELF-BONDED SILICON CARBIDES
R. Stevens, E. Phillips, and W. G. Hutchings Aug. 1971 23 p refs
(AECL-3791) Avail: AEC Depository Libraries; Atomic Energy of Can., Ltd., Chalk River: $1.00

The fracture strength of several different self-bonded silicon carbide materials was measured and the effects of variables such as microstructure, surface finish, mechanical testing technique, and specimen size examined. The criterion governing a useable stress at low probabilities of failure was found to be the reproducibility of properties rather than a high average fracture strength. From an analysis of the experimental data, deductions were made to optimize the fracture stress by a choice of suitable microstructures and surface finishes.
Author (NSA)

N72-22547# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
DEFECTS INTRODUCED INTO Be AND Mg BY IRRADIATION AND COLD WORKING AT LOW TEMPERATURES Ph.D. Thesis - Paris Univ., Orsay, France [CONTRIBUTION A L'ETUDE DES DEFAUTS CREES DANS LE BERYLLIUM ET LE MAGNESIUM PAR IRRADIATION ET ECROUISSAGE A BASSE TEMPERATURE]
Jean-Claude Nicoud Jul. 1971 154 p refs In FRENCH
(CEA-R-4134) Avail: AEC Depository Libraries

The creation of defects in Be and Mg by electron and neutron irradiation or by cold working at low temperatures, and the recovery from these defects were studied using various experimental techniques (electric resistivity, stored energy, internal friction, and electron microscopy). The curves representing the defects created by irradiation exhibit a saturation with increasing dose. Recovery from the irradiation defects occurs in very different ways for the two metals. The process is discussed in terms of classical models proposed for fcc metals. The introduction of defects into Be and Mg by cold working at low temperatures leads to an increase in the electrical resistivity with the deformation which is similar to that observed in other cph metals and much larger than that observed with fcc metals. The recovery from these defects for the two metals occurs in a complex manner between 77 and 500 K. Cold worked Be undergoes large changes in the dislocation lattice between 300 and 500 K. Author (NSA)

N72-22548# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
EFFECT OF OXYGEN ON THE COMPATIBILITY OF TANTALUM AND POTASSIUM
R. L. Klueh Nov. 1971 28 p refs
(Contract W-7405-eng-26)
(ORNL-4737) Avail: NTIS

Static capsule tests were used to study the effect of oxygen in either phase on the compatibility of tantalum and potassium at 600, 800, and 1000 C. As the oxygen concentration of the potassium was increased, the amounts of tantalum in potassium after test also increased. The results indicate the formation of an unidentified ternary oxide phase (probably at the tantalum-potassium interface) that is either nonadherent or dissolved when the potassium is dissolved for chemical analysis. On the other hand, when the tantalum specimens contained oxygen above some threshold concentration that depends on test conditions, potassium penetrated the tantalum; both intergranular and transgranular attack occurred. The threshold levels for intergranular attack at 600, 800, and 1000 C were determined to be 500, 700, and 1000 ppM Om respectively. Again the explanation involves the formation of a ternary oxide phase.
Author (NSA)

N72-22549# North Carolina Univ., Chapel Hill.
PROGRAM FOR THE INVESTIGATION OF THE PROPERTIES OF METALS AND ALLOYS THROUGH THE USE OF SUITABLE NUCLEAR MEASUREMENTS AND OF OTHER RELATED EXPERIMENTAL AND THEORETICAL TECHNIQUES Progress Report, 1 Dec. 1970 - 1 Dec. 1971
Louis D. Roberts 1 Dec. 1971 23 p refs
(Contract AT(40-1)-3897)
(ORO-3897-3) Avail: NTIS

Mossbauer effect and X-ray chemical shift studies are among the topics discussed. Other investigations reported are of high pressure Kondo effect, pseudo-potential calculation of the Mossbauer isomer shift for Au alloyed in Ag, as a function of pressure; effects of local atomic order in Cu3Au from Au-197 Mossbauer effect measurements; effects of high pressure on resistivity of a dilute Cu(Fe) alloy; and the design of a bent crystal X-ray spectrometer for measuring X-ray chemical shifts.
K.P.D.

N72-22550# California Univ., Berkeley.
RESISTANCE OF TRIP STEELS TO HYDROGEN EMBRITTLEMENT Ph.D. Thesis
Robert Allyn McCoy May 1971 90 p refs
(Contract W-7405-eng-48)
(LBL-135) Avail: NTIS

Two objectives were sought: (1) the determination and understanding of cathodic charging, H2 environment, and load conditions for which alpha martensite transformation-induced plasticity (TRIP) steels can be used without hydrogen embrittlement (HE), as well as determining the limiting conditions beyond which they become susceptible to HE, and (2) the development of a high strength epsilon martensite TRIP steel which is relatively immune to HE even under the most severe conditions. Experiments were designed and performed to test several hypotheses regarding the behavior of TRIP steel specimens which had been cathodically charged with hydrogen or mechanically tested in pure H2. It was found that TRIP steels are much more resistant to HE than are martensitic steels of comparable strength. Unlike martensitic steels, TRIP steels never embrittles prior to yielding. It was demonstrated that a high strength epsilon martensite TRIP steel can be developed, and that if no alpha martensite is formed prior to or during its use, it will remain immune to HE. Recommendations for further development of HE-immune alloys are presented. Author

N72-22551# California Univ., Berkeley. Lawrence Berkeley Lab.
INTERPHASE INTERFACES IN SPINODAL ALLOYS
M. Bouchard, R. J. Livak, and G. Thomas Aug. 1971 32 p refs Presented at the Intern. Conf. on the Struct. and Properties of Grain Boundaries and Interfaces, Yorktown Heights, N. Y., 23-25 Aug. 1971
(Contract W-7405-eng-48)
(LBL-152; Conf-710830-1) Avail: NTIS

Detailed electron metallographic studies were made of interfacial dislocations which are formed to relieve the elastic coherency strains developed upon long aging of spinodal alloys in the systems Cu-Ni-Fe and Cu-Mn-Al. The stresses generated by the coherency strains are sufficiently large to exceed the yield strength of the alloys so that the interface dislocations can be generated by plastic deformation. These slip dislocations accommodate the lattice mismatch at the interphase interfaces. The geometry of the arrangements is determined by the operative slip systems, by the degree of long range order (if any) and by the requirement that the Burgers vector or a large component thereof also lies in the interface plane. The model proposed for the formation of the interface dislocations suggests that during coarsening, the two coherent spinodal phases experience tensile and compressive stresses producing dislocations which glide on slip planes from opposite interfaces and are then incorporated into the interface. Author

N72-22552# Utah Univ., Salt Lake City. Div. of Materials Science and Engineering.
IMPURITY EFFECTS ON THE CREEP OF POLYCRYSTALLINE MAGNESIUM AND ALUMINUM OXIDES AT ELEVATED TEMPERATURES Technical Progress Report, 19 Dec. 1970 - 18 Dec. 1971
Ronald S. Gordon Dec. 1971 49 p refs
(Contract AT(11-1)-1591)
(COO-1591-18; UTEC-MSE-71-230) Avail: NTIS

The effects of transition metal impurities and oxygen partial pressure changes on the creep of polycrystalline MgO and Al2O3 are discussed. The role of impurities on the control of microstructure and creep behavior is also considered. Transient creep behavior in iron-doped polycrystalline MgO is analyzed in terms of transient diffusional creep theories. The effects of temperature, grain size, and impurities on the transient are discussed. A general mass transport theory for the diffusional creep of ionic solids is described. The effects of transition metal impurities, temperature, grain size, and oxygen partial pressure on the relative roles of cation lattice and anion grain boundary diffusion in the creep of polycrystalline MgO and Al2O3 are analyzed. Finally, a redesign of the hot pressing facility, which allows for the high temperature fabrication of doped, polycrystalline Al2O3 and MgO, is described. Author

N72-22553# Rolls-Royce, Ltd., Leavesden (England). Small Engines Div.

FACTORS INFLUENCING THE PERFORMANCE OF CORROSION INHIBITING SYSTEMS

R. Salmon London Dept. of Trade and Ind. 1971 112 p refs (Contract KS/1/0619/CB(a)-2)
(D-MAT-169) Avail: NTIS

A correlation is shown between aluminum corrosion prevention and the chromate leaching rates of primers, and possible minima for protection are suggested. An improved cell method has been developed for determining these leaching rates. This method was used in the development of a standard strontium chromate pigmented epoxy polyamide primer. The permeabilities of three finishes to water and water vapor have been determined. The effects of the finishes of leaching and on corrosion prevention are described. Several corrosion tests have been compared. The most satisfactory test piece is still the riveted, simulated aircraft skin panel. In addition to conventional chromate inhibitors, several other materials have been investigated for their inhibitive characteristics, if any. Author (ESRO)

N72-22554# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Dept. d'Etudes et de Recherches en Technologie Spatiale.

ADHESION ENERGY OF METALS SELF - CONSISTENT THOMAS FERMI MODEL

M. DjafariRouhani and R. Schuttler Dec. 1971 34 p refs (ONERA-NT-02-28-71) Avail: NTIS

Metal-metal and metal-vacuum surface energies are calculated to study the adhesion between metals. The theory of the inhomogeneous free electron gas derived from the electron density distribution is used in a simplified form to evaluate all different contributions. The model is seen to be valid for low electron density metals where the agreement with experiment is good, as for the calculation of cohesive energy of metals. The metal-metal surface energy is found to be an almost linear function of the difference between the electronic radius of the two metals. The adhesion energy is essentially due to the metal-vacuum surface energy of the two components. Adsorbed layers affect the metal-metal surface energy. Author (ESRO)

N72-22555# British Iron and Steel Research Association, London (England). Metallurgy Dept.

ANALYTICAL CHEMISTRY IN THE STEEL INDUSTRY: 1970

P. H. Scholes Nov. 1971 9 p Supersedes Q/75/70
(PB-205163; BISRA-MG/CC/503/71; Q/75/70) Avail: NTIS CSCL 11F

The trend towards more exacting engineering standards has emphasised the need for more detailed information and closer tolerances on both the mechanical properties and chemical composition of steel. Much of the routine chemical analysis may now be performed by direct reading instrumental methods based upon emission spectroscopy and X-ray fluorescence. For certain purposes, these techniques may not always be adequate and a different approach may be necessary based upon alternative forms of analytical measurement. An attempt is made to review the state of the art of the analytical chemistry of steel and related materials, and to identify problem areas where future research effort must be directed. Author (GRA)

N72-22556# British Steel Corp., London (England). General Steels Div.

THE RELATIONSHIP BETWEEN MICROSTRUCTURE AND CREEP STRENGTH IN FERRITIC STEELS

J. D. Baird 1971 16 p refs
(PB-205105; GS/RO/PROD/131/6/71/C) Avail: NTIS CSCL 11F

It is shown that in carbon/manganese steels and in molybdenum steels under certain conditions, solid solution strengthening effects arising from interaction between intestitial and substitutional solutes are responsible for most of the creep strength. In steels containing vanadium, dispersion strengthening effects normally predominate, while in other steels either solid solution or dispersion strengthening may be more important depending on prior thermal treatment and testing conditions. Mechanisms for creep strengthening in these different situations are discussed. Author (GRA)

N72-22557# British Steel Corp., London (England). General Steels Div.

AUTOMATIC PHOTOMETRIC DETERMINATION OF BORON IN MILD STEEL

R. R. Willis Nov. 1971 11 p
(PB-205104; GS/RO/TECH/1/71/C) Avail: NTIS CSCL 11F

An automatic photometric procedure for the determination of boron in steel using a technicon auto analyzer was assessed for the accuracy, repeatability and speed to determine its suitability for application for routine and reference analysis of plain and low alloy steels. The procedure was found to be more repeatable, simpler to operate, and faster than manual methods, but interference from titanium requiring application of corrections restricts its application to routine analysis. Author (GRA)

N72-22558# British Iron and Steel Research Association, London (England). Metallurgy Dept.

THE ARREST OF PROPAGATING CRACKS

I. Gray and A. H. Priest Nov. 1971 10 p refs Presented at the Inst. Mech. Engr. Conf., 3-5 May 1971
(PB-205099; MG/32/71) Avail: NTIS CSCL 11F

Loading systems having very high spring constants can be used to obtain a net reduction of stress intensity with increasing crack length in conventional fracture toughness specimens. Crack arrests were produced in specimens of En 20A, En 30B, and a low carbon experimental steel tested in such a system. The En 20A and the low carbon steel showed unstable crack propagation at temperatures in the range -110 to -160 C, with initiation and arrest occurring at similar stress intensities. The En 30B steel showed slow stable crack growth under a rising stress intensity. This was attributed to employing a stiff loading system with a material prone to crack tunneling. The arrest stress intensity for this material depended upon the loading system stiffness and was not, therefore, a material property.
Author (GRA)

N72-22559# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE STATISTICAL THEORY OF DISPERSION OF A RANDOM COORDINATE OF BODY DAMAGE

R. D. Vagapov 4 Nov. 1971 24 p refs Transl. into ENGLISH from Mashinovedenie (USSR), no. 4, 1970 p 63-74
(AD-736496; FTD-MT-24-1268-71) Avail: NTIS CSCL 11/6

The article discusses the problem of body damage in terms of the combined density of random values of strength and longevity. GRA

N72-22560# Aerospace Corp., El Segundo, Calif.

EFFECT OF SILICON ADDITIONS ON THE CARBURIZATION RESISTANCE, MECHANICAL PROPERTIES, AND JOINING CHARACTERISTICS OF STABILIZED AUSTENITIC STAINLESS STEELS Technical Report, Jan. - Dec. 1970

James K. Stanley 15 Nov. 1971 40 p refs
(Contract F04701-71-C-0172)
(AD-736438; TR-0172(2250-10)-4; SAMSO-TR-72-1) Avail: NTIS CSCL 11/6

Silicon contents to about 3% increase the resistance to carburization of Type 321 and Type 347 stabilized stainless steels. Tests were conducted at 1700F (925C), 1800F (980C), and 1900F (1040C) in a mixture of methane-hydrogen. Silicon additions to Type 321 steel are more effective in reducing carburization than additions to Type 347. Under the conditions used, a 3% silicon concentration in Type 321 makes the alloy completely resistant to carburization for 1 hour at 1700F (925C) and 1800F (980C). The mechanical properties and joining

characteristics (welding and brazing) were also studied.
Author (GRA)

N72-22561# Battelle Memorial Inst., Columbus, Ohio.
THEORY OF TITANIUM ALLOYS FOR HIGH TEMPERATURE STRENGTH Final Report, 1 Apr. 1969 - 31 Aug. 1971
E. W. Collings, J. C. Ho, and R. I. Jaffee Oct. 1971 58 p refs
(Contract F33615-69-C-1594; AF Proj. 7351)
(AD-736053; AFML-TR-71-228) Avail: NTIS CSCL 11/6

Some of the mechanical and structural properties of Ti-base alloys are justified from an electronic standpoint. Two classes of alloy are treated: Alpha-stabilized, with nontransition metal solutes such as Al, Ga, or Sn; and beta-stabilized, with transition metal solutes such as Mo. The results of measurements of various electronic properties, including electrical resistivity, Hall coefficient, low-temperature specific heat, and magnetic susceptibility, are shown to contribute to understandings of the electronic bonding mechanisms, and solid-solution strengthening effects in these two classes of alloy. Author (GRA)

N72-22562# Illinois Univ., Urbana. Dept. of Theoretical and Applied Mechanics.
FATIGUE FAILURE PREDICTIONS FOR COMPLICATED STRESS-STRAIN HISTORIES
N. E. Dowling Jan. 1971 87 p refs
(Contract N00156-70-C-1256)
(AD-736583; UILU-ENG-71-6001; T/AM-337) Avail: NTIS CSCL 11/6

A cumulative damage procedure is developed to predict the fatigue failure of engineering metals subjected to complicated stress-strain histories. Histories with plastic strainings and cycles not completely reversed in stress are considered. The relationship between stress-strain behavior and fatigue life is investigated for unnotched axially loaded specimens for which the stresses and strains can be measured for the duration of all tests. Since either the stress history or the strain history was known before each test was conducted, the other could be estimated and a life prediction made. A general cumulative damage procedure is used to make life predictions for a wide variety of complicated history tests on 2024-T4 aluminum. GRA

N72-22563# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
SYNTHESIS OF SHAPE, STRUCTURE, AND PROPERTIES BY CONTROL OF METALLURGICAL PROCESSING VARIABLES Technical Report, 16 Nov. 1968 - 15 Dec. 1970
Alan T. Male and Fred J. Gurney Sep. 1971 40 p refs
(Contract F33615-69-C-1198; AF Proj. 7351)
(AD-736047; AFML-TR-71-103) Avail: NTIS CSCL 13/8

The report summarizes the findings of several investigations into the synthesis of product shape, metallurgical structure, and mechanical properties by suitable control of metallurgical processing variables. Two of the most significant achievements are: Additional work on the ring compression test has considerably enhanced its usefulness to the point where it can now be used for the quantitative determination of not only friction, but also the dynamic flow properties of metals under typical metal working conditions. It can also now be used as an accurate technique for the tonnage calibration of both large and small forge presses; It has been shown that significant strength improvements can be achieved for alpha and alpha 2 beta titanium alloys by processing at temperatures such that the material is in the full beta range and then water quenching immediately after deformation. Author (GRA)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N72-22564 National Lending Library for Science and Technology, Boston Spa (England).
ALUMINIUM/PLASTICS COMPOSITE MATERIAL
D. Altenpohl and St. Acel [1968] 19 p refs Transl. into ENGLISH from Aluminium (West Germany), v. 44, no. 3, Mar. 1968 p 155-160
(NLL-M-22007-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Composites of aluminum and plastics were studied for commercial applications. The constraints considered were: (1) The composite material should be deformable and workable in the same manner as a solid sheet. (2) The composite material should be either equal in price or cheaper than solid sheets of equal stiffness. (3) The composite material should be considerably lighter than a solid sheet. The applications of composite sheets, joining systems, mechanical stresses, and dimensioning of composites are discussed. It is concluded that aluminum-plastic composite plates are useful when high bending strength and low specific weight are required. F.O.S.

N72-22565 National Lending Library for Science and Technology, Boston Spa (England).
SOME PHYSICAL PROPERTIES OF PYROLITIC BORON CARBIDE
V. S. Neshpor Jan. 1972 13 p refs Transl. into ENGLISH of "Nekotorye fizicheskie svoistva piroliticheskogo karbida bora" in the publ. "Tugoplavkie Karbidy" Kiev, Naukova Dumka, 1970 p 132-138
(NLL-RTS-6961) Avail: Natl. Lending Library, Boston Spa, Engl.: £1.20 or 4 NLL photocopy coupons

The specific electrical resistance, absolute differential thermo-emf in the temperature interval of 20 to 1000 C, the Hall coefficient, thermal conductivity, and microhardness were measured for monolithic samples of pyrolytic boron carbide with a theoretical density and compact lamellar-columnar structure. In the temperature range investigated, boron carbide is an impurity p-type semiconductor. The activation energy of the impurity current carriers is 0.22 eV; the level of the chemical potential is loacted in the middle of the energy gap between the ceiling of the valency zone and the acceptor level. The P conductivity of boron carbide is evidently determined by the partial replacement of carbon atoms in boron carbide of limiting compositon B4C = (B12)C3 by boron atoms with lower valency. Author

N72-22566* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
INORGANIC THERMAL CONTROL COATINGS Patent
Albert C. Krupnick, inventor (to NASA) Issued 16 Nov. 1971 5 p Filed 2 Apr. 1969 Supersedes N69-33483 (07 - 19, p 3608)
(NASA-Case-MFS-20011; US-Patent-3,620,791; US-Patent-Appl-SN-813338; US-Patent-Class-106-288B; US-Patent-Class-106-84; US-Patent-Class-106-286) Avail: US Patent Office CSCL 11C

Inorganic coating compositions are based on a binder obtained by gelling a suspension of synthetic mica or sodium magnesium fluorolithosilicate mineral with a solution of soluble metal silicate or sulfate. Pigments and other additives are included to provide desired optical properties. For solar reflector coatings, zinc oxide pigment and hollow glass microspheres are employed. Official Gazette of the U.S. Patent Office

N72-22567* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
IONENE MEMBRANE SEPARATOR Patent
Jovan Moacanin and Ho Yet Tom, inventors (to NASA) Issued 21 Dec. 1971 4 p Filed 24 Sep. 1969 Supersedes N70-34742 (08 - 18, p 3369) Sponsored by NASA
(NASA-Case-NPO-11091; US-Patent-3,629,161; US-Patent-Appl-SN-860781; US-Patent-Class-260-2.1E) Avail: US Patent Office CSCL 11I

A water-insoluble, cationic, permselective membrane is described, which comprises a hydrocarbon, quaternary nitrogen-containing, ionene polymer, cross-linked to a polyvinyl alcohol 15 substrate. Official Gazette of the U.S. Patent Office

N72-22568*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
THERMAL-OPTICAL PROPERTIES OF FLUOREL L-3203-6 AND 1059
B. French Washington Apr. 1972 19 p refs
(NASA-TN-D-6751; MSC-S-292) Avail: NTIS CSCL 11D

Fluorel L-3203-6 and 1059 and four Fluorel derivatives were irradiated monochromatically and hemispherically with electromagnetic energy in the solar- and infrared-wavelength range to determine the thermal-optical properties that are required for engineering analysis. The thermal-optical properties were measured and analyzed, and the resulting data were tabulated for convenient engineering use. The results prove that the electromagnetic-energy distribution and the measured reflectance and transmittance of materials can be used to calculate several mean values, which are the total and hemispherical thermal-optical properties. The test results also illustrate that Fluorel effectively absorbs energy in the solar- and infrared-wavelength range. In addition, the results demonstrate that fabrication alters the thermal-optical properties of Fluorel.
Author

N72-22569*# Fabric Research Labs., Inc., Dedham, Mass.
DEVELOPMENT OF FLAME RESISTANT METAL AND METAL-GLASS BLENDED STRUCTURES Final Report
R. J. Coskren Dec. 1971 13 p
(Contract NAS9-7397)
(NASA-CR-115537) Avail: NTIS CSCL 11D

A description is given of the design and fabrication of candidate flame-resistant woven and knitted fabrics, tapes, webbings, and cords as replacements for those items used in the Apollo spacecraft which were previously made of nylon and polyester. Structures made from Chromel R metal fibers (74% Ni, 20% Cr, 2-1/2% Fe, 2-1/2% Al, 1/2% Si, 1/2% Mo), Beta glass fibers and high-temperature organic fibers such as PBI (polybenzimidazole) were developed and evaluated. The feasibility of improving the performance of selected fabrics by using CNR (carboxy nitroso rubber) or other nonflammable coatings were also investigated.
Author

N72-22570# Joint Publications Research Service, Arlington, Va.
THERMODYNAMIC CHARACTERISTICS OF REFRACTORY COMPOUNDS
R. F. Voytovich 28 Apr. 1972 237 p refs Transl. into ENGLISH of the book "Tugoplavkiye Soyedineniya, Termodinamicheskiye Kharakteristiki" Kiev, Naukova Dumka, 1 Dec. 1970 p 1-220
(JPRS-55832) Avail: NTIS

Data are presented on the high temperature stability of refractory compounds in various media. Results are given of thermodynamic equilibrium calculations in systems of refractory compounds: oxygen, carbon, boron, metal. Equilibrium was studied in borode-oxygen, boride-nitrogen, boride-carbon, carbide-oxygen, carbide-nitrogen, carbide-metal, nitride-oxygen, nitride-carbon systems in the temperature interval between 298 and 2000 K. Data are presented on the stability of borides, nitrides and silicides in a vacuum, as well as the thermodynamic characteristics of reactions in metal-oxide and oxide-carbon systems within the limits of the entire periodic system. The results of the calculation of equilibria for more than 2500 reactions are illustrated with graphic materials.
Author

N72-22571# Joint Publications Research Service, Arlington, Va.
NEW INDUSTRIAL MATERIALS
Ye. I. Belskiy 26 Apr. 1972 93 p Transl. into ENGLISH from the book "Novyye Materialy v Tekhnike" Minsk, Belarus Publishing House, 18 May 1971 106 p
(JPRS-55807) Avail: NTIS

Topics considered are high alloy steels and other alloys, titanium and zirconium and their alloys, rare and refractory metals, and protective coatings. The production of these industrial materials, their physical and worked characteristics, and applications are discussed.
K.P.D.

N72-22572# Sandia Labs., Albuquerque, N.Mex.
EPOXY-RESIN-ENCAPSULATED COMPOUND SHEETS FOR USE AS X-RAY K-EDGE TRANSMISSION FILTERS
J. J. Hohlfelder Dec. 1971 8 p
(SC-DR-710767) Avail: NTIS

Epoxy-resin-encapsulated compound sheets were fabricated for use as X-ray K-edge transmission filters or for use in pairs as X-ray Ross filters. An individual filter consists of a uniform sheet or film of a cured epoxy resin mixture containing a fine dispersion of a compound of the element whose X-ray K-edge transmission properties are required. The use of these X-ray filters is suggested for applications in which conventional metal foil or elemental filters are difficult to fabricate, chemically active in their elemental form, or so fragile that their routine use in not recommended.
Author

N72-22573# Aerospace Corp., El Segundo, Calif.
THERMAL EXPANSION MEASUREMENTS IN THE Nb2O5-Ta2O5 SYSTEM
G. Dwayne Kidwell, James H. Richardson, and Gerard M. Wolten 15 Dec. 1971 35 p refs
(Contract F40701-71-C-0172)
(AD-736026; TR-0172(2250-40)-1; SAMSO-TR-71-338) Avail: NTIS CSCL 11/2

Optical interferometry and X-ray diffractometry have been used to measure the thermal expansion of selected compositions in the Nb2O5 - Ta2O5 system. A 70 wt% Nb2O5 - 30 wt% Ta2O5 composition has a coefficient of thermal expansion of 0.12 X 10 to the minus 6th power in the temperature range 22 to 346C. Coefficients of thermal expansion for three orthogonal directions of 99.9% pure Nb2O5 were measured over two temperature ranges.
Author (GRA)

N72-22574# Watervliet Arsenal, N.Y.
CRACK GROWTH RESISTANCE IN LAMINATED, GLASS EPOXY SHEET
D. P. Kendall Oct. 1971 26 p refs
(DA Proj. 1F0-61102-A-35D)
(AD-736351; WVT-7158) Avail: NTIS CSCL 11/9

The application of the concepts of linear, elastic fracture mechanics to multi-directional, laminated glass-epoxy composite material is investigated. Center notched panels having filament orientations of 0 degrees and plus or minus 60 degrees are loaded in tension normal to the notch direction. Extensive stable crack growth is obtained prior to fracture. Crack extension and applied load are simultaneously measured using a motion picture camera. The instantaneous stress intensity factor is calculated using theory developed for isotropic materials, and is plotted against crack extension to obtain crack growth resistance or 'R' curves.
Author (GRA)

N72-22575# Pennsylvania State Univ., University Park. Materials Research Lab.
GLASSY CARBON, ALLOYS Semiannual Technical Report, 1 Jun. - 31 Dec. 1971
P. L. Walker, Jr. 20 Jan. 1972 45 p
(Contract DAHC15-71-C-0290)
(AD-736378) Avail: NTIS CSCL 11/6

The research program has as one of its main objectives to determine the possibilities of ultimately modifying the structure

and properties of glassy carbon by the addition of various elements to the starting organic precursors. Another main objective is to study the effects of the application of pressure during polymerization and/or carbonization of glassy carbon precursors on the structure and properties of carbons produced.
Author (GRA)

N72-22576# Naval Research Lab., Washington, D.C. Ocean Sciences Div.
AN INVESTIGATION OF MARINE BORER RESISTANCE OF POLYMERIC MATERIALS Final Report
J. D. Bultman and C. R. Southwell 28 Dec. 1971 22 p refs (NRL Proj. G04-01)
(AD-736180; NRL-7343) Avail: NTIS CSCL 11/9

Marine borer resistance of various experimental polymeric materials, otherwise suitable for marine electric cable insulation, was evaluated. Twenty-five candidate formulations containing polyvinyl chloride (PVC) resin were prepared. Four non-PVC formulations containing chlorosulfonated polyethylene, ethylenepropylene rubber, chlorinated polyethylene, and crosslinked polyethylene respectively were also prepared. One commercial plastic, cellulose acetate-butyrate, was included. No marine boring organisms attacked the plastics directly from the water; all damage occurred at the wood plastic interfaces. None of the formulations were completely immune to attack by both teredos and pholads, although the non-PVC polymers were much more resistant to both than the PVC formulations. The PVC formulations containing the inert, inorganic fillers were virtually undamaged by teredos; those containing toxicants were also relatively free of damage by these organisms. Creosote as a co-plasticizer protected one of the PVC formulations against teredos.
Author (GRA)

N72-22577# General Electric Co., Philadelphia, Pa. Missile and Space Div.
DEVELOPMENT OF A PROCESS FOR PRODUCING TRANSPARENT SPINEL BODIES Final Report, 15 Oct. 1970 - 15 Dec. 1971
A. Gatti, R. L. Mehan, and M. J. Noone Washington Naval Air Systems Command Dec. 1971 76 p refs
(Contract N00019-71-C-0126)
(AD-736980) Avail: NTIS CSCL 11/2

Transparent spinel material was made and processing variables documented. Present studies involved continued improvement of reproducibility and the characterization of the process and the material it produces, and included the substitution of commercially available spinel or alumina raw materials, the kinetics of volatile additive removal, and the documentation of acoustic emissions during mechanical testing from spinel, alumina, and Lucalox R alumina.
Author (GRA)

N72-22260*# Aerospace Corp., El Segundo, Calif.
RADIATION EFFECTS ON CONTAMINANTS FROM THE OUTGASSING OF SILASTIC 140 RTV
Peter F. Jones *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 173-177 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 11D

N72-22275*# National Research Corp., Cambridge, Mass.
THE DETERMINATION AND OPTIMIZATION OF (RUTILE) PIGMENT PARTICLE SIZE DISTRIBUTIONS
L. Willard Richards *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 409-423 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 11C

N72-22277*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
EFFECTS OF SURFACE BUBBLES ON HEAT-TRANSFER CHARACTERISTICS OF SPACECRAFT PAINTS
Reagan S. Redman *In its* Space Simulation 1972 p 445-452 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 11C

N72-22301*# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Labs.
A VACUUM THERMOGRAVIMETRIC METHOD FOR OUTGASSING EVALUATIONS OF SILICONE-COATED FIBERGLASS CLOTH
L. B. Jensen, G. B. McCauley, M. Honma, and A. E. Hultquist *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 831-841 refs (See N72-22250 13-11)
(Paper-73) Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 11D

N72-22302*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PREDICTION OF THE MECHANICAL PROPERTIES OF A FILLED ELASTOMER IN VACUUM
Gerald L. Gregory *In its* Space Simulation 1972 p 843-857 refs (See N72-22250 13-11)
(Paper-74) Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 11D

N72-22303*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ACCELERATED TESTING OF A FILLED ELASTOMER IN VACUUM
Morris L. Evans (Va. Polytechnic Inst.), Thomas C. Ward (Va. Polytechnic Inst.), and Gerald L. Gregory *In its* Space Simulation 1972 p 859-873 refs (See N72-22250 13-11)
(Paper-75) Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 11D

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N72-22578 National Lending Library for Science and Technology, Boston Spa (England).
THE METHOD OF LEAST SQUARES IN PROBLEMS OF DYNAMICAL SYSTEM IDENTIFICATION
Ju. P. Leonov [1971] 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), no. 198, 1971 p 64-67
(NLL-M-22003-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The solutions of a special class of Fredholm's integral equations of the first kind were studied. These equations were obtained in the solution of the problem of identification of a dynamic system using the least squares method. Two cases are considered: one point of perturbation in the system accessible to observations, and only steady motion of the system accessible.
Author

N72-22579*# Stanford Univ., Calif. Guidance and Control Lab.
STATE ESTIMATION WITH SMALL NONLINEARITIES
Bjoern Conrad Mar. 1971 94 p refs
(Grant NGR-05-020-019; Contracts F33615-67-C-1245; F33615-70-C-1637)
(NASA-CR-126145; SUDAAR-421; AFAL-TR-71-222) Avail: NTIS CSCL 12A

A variety of techniques is available for estimating the states of nonlinear dynamic systems from noisy data. The differences among several of these procedures in the presence of small dynamic and observational nonlinearities are investigated. Four discrete estimation algorithms are analyzed. The first is a strictly least square estimator, while the others are recursive algorithms

similar to the Kalman filter used for estimating the states of linear systems. A group of analytic expressions is developed for the mean and covariance of the error in each of these estimators so that they may be compared without lengthy Monte Carlo simulations. The covariance expressions show that, to first order, all the estimators have the same covariance. Expressions for the means show that each estimator has a different bias. Several examples are carried out demonstrating that the relative magnitudes of the bias errors in the various estimators can be a strong function of such parameters as initial covariances and number of data points. Under some circumstances, more complicated algorithms can have larger biases than smaller ones.
Author

N72-22580*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DISTRIBUTION OF ERROR IN LEAST-SQUARES SOLUTION OF AN OVERDETERMINED SYSTEM OF LINEAR SIMULTANEOUS EQUATIONS
C. David Miller Washington Apr. 1972 47 p refs
(NASA-TN-D-6744; E-6670) Avail: NTIS CSCL 12A

Probability density functions were derived for errors in the evaluation of unknowns by the least squares method in system of nonhomogeneous linear equations. Coefficients of the unknowns were assumed correct and computational precision were also assumed. A vector space was used, with number of dimensions equal to the number of equations. An error vector was defined and assumed to have uniform distribution of orientation throughout the vector space. The density functions are shown to be insensitive to the biasing effects of the source of the system of equations.
Author

N72-22581*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SYSTEMS IDENTIFICATION USING A MODIFIED NEWTON-RAPHSON METHOD: A FORTRAN PROGRAM
Lawrence W. Taylor, Jr. and Kenneth W. Iliff Washington May 1972 76 p refs
(NASA-TN-D-6734; L-8028) Avail: NTIS CSCL 12A

A FORTRAN program is offered which computes a maximum likelihood estimate of the parameters of any linear, constant coefficient, state space model. For the case considered, the maximum likelihood estimate can be identical to that which minimizes simultaneously the weighted mean square difference between the computed and measured response of a system and the weighted square of the difference between the estimated and a priori parameter values. A modified Newton-Raphson or quasilinearization method is used to perform the minimization which typically requires several iterations. A starting technique is used which insures convergence for any initial values of the unknown parameters. The program and its operation are described in sufficient detail to enable the user to apply the program to his particular problem with a minimum of difficulty.
Author

N72-22582# Laboratoire d'Automatique et de Ses Applications Spatiales, Toulouse (France).
NONLINEAR DISCRETE CONTINUOUS FILTERING: THEORY, APPLICATION TO THE ESTIMATION OF PARAMETERS OF A LINEAR SYSTEM; EXTENSION TO OTHER PROBLEMS [FILTRAGE NON LINEAIRE CONTINU-DISCRET: THEORIE, APPLICATION A L'ESTIMATION DES PARAMETRES D'UN SYSTEME LINEAIRE, EXTENSION A D'AUTRES PROBLEMES]
G. Alengrin Jul. 1971 36 p refs In FRENCH
(LAAS-NI-832) Avail: NTIS

Nonlinear continuous discrete filtering represents an evaluation of the state of continuous Markov processes defined by a nonlinear stochastic differential equation. The evolution of the probability density function transition of the Markov process in the time lag between two samplings is analyzed. The Bayes theorem is then used to reset the probability density function at sampling time.
ESRO

N72-22583# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.
THE RELATIONSHIP BETWEEN THE APPROXIMATE HESSIAN MATRICES GENERATED BY A CLASS OF QUASI-NEWTON METHODS
W. Murray Jan. 1972 13 p refs
(NPL-NAC-12) Avail: NTIS

It is shown how, under certain conditions, the approximation to the Hessian matrix generated by using one quasi-Newton method is related to the approximation obtained using an alternative method. It is also shown that under the same conditions the directions of search generated by a certain class of quasi-Newton methods are identical apart from a scalar multiplier. The value of the scalar multiplier is a direct consequence of the relationship derived between the approximate Hessian matrices.
Author (ESRO)

N72-22584# Royal Aircraft Establishment, Farnborough (England).
THE SOLUTION OF OPTIMAL CONTROL PROBLEMS BY FUNCTION MINIMISATION METHODS
B. A. M. Piggott Jul. 1971 33 p refs
(RAE-TR-71149; BR-26509) Avail: NTIS

Numerical methods for locating the constrained minimum function of several variables which can be used to solve optimal control problems are described. Fortran programs have been written to carry out this type of calculation; some simple examples of the results obtained in this way are presented.
Author (ESRO)

N72-22585# Elliott-Automation Space and Advanced Military Systems, Ltd., Camberley (England).
HOW TO HANDLE THREE-DIMENSIONAL NORMAL (GAUSSIAN) DISTRIBUTIONS
D. J. Cashmore Jan. 1972 18 p refs
(ETN-3) Avail: NTIS

The statistical theory is discussed for problems dealing with three dimensional normal distributions. Such a problem may be the occurrence of simultaneous errors in three dimensions (n, y, z). If each component error has a normal distribution with standard deviations, and furthermore if these deviations are correlated one with another, the resultant spatial distribution of P(x, y, z) is characterized by ellipsoids of constant probability. The treatment is restricted to the case when different distributions have a common center or mean point, and to find the distribution of the distance r between P and the center (miss distance).
ESRO

N72-22586# Naval Postgraduate School, Monterey, Calif.
AN INFORMATION THEORY APPROACH TO A FAULT LOCATION PROBLEM M.S. Thesis
David Russell Campbell Sep. 1971 82 p refs
(AD-736534) Avail: NTIS CSCL 12/2

The fault location model under investigation consists of a n-component series system known to have exactly one failed component. Component positions in the system are taken as fixed. A component is either working or failed. Components work or fail independently of each other, with their a priori reliabilities taken as given but not necessarily equal. Group testing to locate the failed component is sequential, binary and dichotomous in nature with certain results. The only costs are the number of tests made. The three solution procedures investigated are: (1) A dynamic programming formulation, (2) A sequential halving procedure, and (3) A procedure based on information theory. The criteria for optimality are minimization of the expected number of tests required and minimization of the maximum number of tests required.
Author (GRA)

N72-22587# Naval Weapons Center, China Lake, Calif.
ANALYSIS OF A DISCRETE MATRIX RICCATI EQUATION OF LINEAR CONTROL AND KALMAN FILTERING
G. A. Hewer Dec. 1971 19 p refs

(AD-736606; NWC-TP-5124) Avail: NTIS CSCL 12/1

A characterization of the interrelationship between the recursive Riccati difference equation and its steady-state form is developed via the method of quasi-linearization. Not only does this approach unify the discussion, but also strengthens known results. In addition, this method yields an algorithm for computing the solution of the steady-state equation.

Author (GRA)

N72-22588# Army Missile Command, Redstone Arsenal, Ala.

A METHOD FOR GEOGRAPHIC-CARTESIAN COORDINATE TRANSFORMATION: THE SAM-D PROJECT

James C. Harrington 27 Oct. 1971 19 p

(AD-736364) Avail: NTIS CSCL 12/1

The report presents parameters, mathematics, and procedures of a geographic-Cartesian coordinate transformations method which can be used to calculate the Cartesian coordinates, (X, Y, Z), of a geographic point which respect to a second geographic point.

Author (GRA)

N72-22589# Texas A&M Univ., College Station. Inst. of Statistics.

STATISTICAL CONTROL OF OPTIMIZATION

H. O. Hartley and R. Pfaffenberger Jan. 1972 30 p refs

(Contract N00014-68-A-0140; NR Proj. 047-700)

(AD-736231; THEMIS-TR-35) Avail: NTIS CSCL 12/2

The paper provides a statistical solution to a very general problem in nonlinear programming. Specifically, it does not make any assumptions about the convexity (or, for that matter, quasiconvexity or pseudo-convexity) of any of the functions involved in the problem. On the other hand, it does not provide a guaranteed global optimum of the objective function, but is confined to the computation of a feasible and near optimum solution, and the computation of confidence limits between which the global optimum is guaranteed to lie with a specified statistical confidence coefficient.

Author (GRA)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N72-22590 Freie Univ., Berlin (West Germany).

METEOROLOGICAL DATA. VOLUME 120, NO. 10: RESULTS OF THE SYNOPTIC SERVICE DURING 1971. DAILY WEATHER MAPS (GROUND, 500 mb), TABLES AND BRIEF SCIENTIFIC ARTICLES, OCTOBER [METEOROLOGISCHE ABHANDLUNGEN. BAND 120, HEFT 10: ERGEBNISSE DES SYNOPTISCHEN DIENSTES IM JAHRE 1971. TAEGLICHE WETTERKARTEN (BODEN, 500MB), TABELLEN UND KLEINERE WISSENSCHAFTLICHE AUFSAETZE, OKTOBER]

1971 199 p In GERMAN

Avail: Issuing Activity

Meteorological data from ground to the 500 millibar level above Berlin, Germany for calendar year 1971 are presented. Daily weather charts, tables of data, and brief scientific articles are included.

Author

N72-22591 Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.

METEOROLOGICAL DATA. VOLUME 122, NO. 6: AEROLOGICAL DATA, BERLIN-TEMPELHOF, JUNE 1971 [METEOROLOGISCHE ABHANDLUNGEN. BAND 122, HEFT 6: AEROLOGISCHE DATEN, BERLIN-TEMPELHOF, JUN. 1971]

1971 166 p refs In GERMAN; ENGLISH summary

Avail: Issuing Activity

The results of radiosonde ascents performed by the aerological station of the Institute for Meteorology of the Free University of Berlin, Germany are presented. Extreme and mean values of the temperature, pressure, geopotential, wind data, refractivity, pseudopotential temperature, and velocity of sound were extracted for all standard pressure surfaces, several height levels, the tropopause, and the freezing level. The temperature curve of the climatological mean and the data of the ozone ascents appear in tabular and graphical form.

Author

N72-22592 Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.

METEOROLOGICAL DATA. VOLUME 122, NO. 5: AEROLOGICAL DATA, BERLIN-TEMPELHOF, MAY 1971 [METEOROLOGISCHE ABHANDLUNGEN. BAND 122, HEFT 5: AEROLOGISCHE DATEN, BERLIN-TEMPELHOF, MAI 1971]

1971 165 p refs In GERMAN; ENGLISH summary

Avail: Issuing Activity

The results of radiosonde ascents performed by the aerological station of the Institute for Meteorology of the Free University of Berlin, Germany are presented. Extreme and mean values of the temperature, pressure, geopotential, wind data, refractivity, pseudopotential temperature, and velocity of sound were extracted for all standard pressure surfaces, several height levels, the tropopause, and the freezing level. The temperature curve of the climatological mean and the data of the ozone ascents appear in tabular and graphical form.

Author

N72-22593# France. Direction de la Meteorologie Nationale, Paris.

CLIMATOLOGY OF NEW CALEDONIA [CLIMATOLOGIE DE LA NOUVELLE CALEDONIE]

J. Girard and D. Rignot Oct. 1971 218 p refs In FRENCH

(Mono-82) Avail: NTIS

Tables and graphs are presented for meteorological parameters and climatology of New Caledonia. Data is given for precipitation, pressure, temperature, air humidity, evaporation, insolation, nebulosity, surface winds, and miscellaneous phenomena.

Transl. by K.P.D.

N72-22594*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

PRECIPITATION CRITERIA GUIDELINES FOR USE IN AEROSPACE VEHICLE DEVELOPMENT

Glenn E. Daniels 22 Mar. 1972 40 p refs

(NASA-TM-X-64650) Avail: NTIS CSCL 04B

Guidelines are presented on probable precipitation extremes and characteristics, applicable for NASA space vehicles and associated equipment development. Information is provided on probability of rainfall rates, drop size, drop rate of fall, associated wind speeds with rainfall, snow loads, hail, laboratory test simulation, and rain erosion.

Author

N72-22595# National Environmental Satellite Center, Washington, D.C.

APPLICATION OF METEOROLOGICAL SATELLITE DATA IN ANALYSIS AND FORECASTING, SUPPLEMENT

Ralph K. Anderson and Arthur H. Smith Nov. 1971 66 p refs

(ESSA-TR-NESC-51-Suppl; AWS-TR-212-Suppl) Avail: SOD $0.65

The use and analysis of satellite obtained infrared data to help forecast weather are discussed. Data cover effects of natural temperature variations on IR pictures, comparison of IR and television pictures, IR interpretation of cloud forms and surface features, and conversion of measured radiances to temperature. Also discussed is overall accuracy of cloud and surface temperature obtained by the satallites. A description is given of the scanning equipment.

E.H.W.

N72-22596# Environmental Technical Applications Center (Air Force), Washington, D.C.

GLOBAL ATLAS OF RELATIVE CLOUD COVER, 1967-1970, BASED ON DATA FROM METEOROLOGICAL SATELLITES

Donald B. Miller and Robert G. Feddes Sep. 1971 241 p refs

Prepared jointly with Natl. Oceanic and Atmospheric Admin.

Avail: NTIS

This atlas was prepared from data acquired during the period 1 January 1967 through 31 December 1970. Picture signals were computer processed to prepare hemispheric charts of monthly, seasonal, semiannual, and annual charts of relative cloud cover, in octas, over both the Northern and Southern Hemispheres. Similar presentations of tropical cloudiness are included. This atlas is one of the first attempts to use satellite data in the preparation of a climatology of daytime cloudiness over the globe. Author

N72-22597# Finnish Meteorological Inst., Helsinki.

CLIMATOLOGICAL DATA FOR JOKIOINEN AND SODANSYLAE OBSERVATORIES, 1970 Meteorological Yearbook for Finland, volume 70, part 1b 1970

Oct. 1971 50 p In ENGLISH and FINNISH

Avail: NTIS

The results of observations made by the meteorological observatories of Jokioinen and Sodankyla in 1970 are presented. Data cover the values obtained from recordings of atmospheric pressure, temperature, relative humidity, wind direction, and speed at even hours. The amount of sunshine and cloud, including cloud formation and height, hydrometeors observed with time of appearance, visibility, and precipitations, are also covered. Author

N72-22598# Bureau of Meteorology, Melbourne (Australia).

REGIONAL INCIDENCE OF CAT AND THE METEOROLOGICAL INTERPRETATION OF ROUTINE FLIGHT LOAD RECORDS

K. T. Spillane Nov. 1971 58 p refs

(Meteorol-Study-21) Avail: NTIS

Seasonal flight loads recorded on routine operations by an F.27 aircraft in Western Australia are examined at two g levels, each of which is contributed by turbulence of significantly different intensity, if all aeronautical turbulence contributing c.g. loads observe similarity in spectra. Examination of the seasonal and diurnal variation of severe convection (thunderstorms) points to the occurrence of seasonal anomalies in loads that are consistent with short length scale CAT mechanisms and are correlated with the seasonal behaviour of the subtropical jet over Western Australia. The power-spectra model of atmospheric turbulence proposed by the Federal Aviation Agency of America is shown to be seasonally nonstationary. Author

N72-22599# Bureau of Meteorology, Melbourne (Australia).

A SINGLE-STATION ANALYSIS OF CLEAR AIR TURBULENCE AND RELATED ATMOSPHERIC STRUCTURE

K. T. Spillane and U. Radok (Melbourne Univ.) Nov. 1971 47 p refs

(Meteorol-Study-20) Avail: NTIS

Pilotless aircraft operating close to Woomera aerological station provided semi-quantitative data on clear air turbulence (CAT) intensity and incidence up to 65,000 ft. An analysis of upper wind and temperature soundings in terms of the main parameters for which association with CAT is claimed shows the Colson-Panofsky index to be most consistently related to the occurrence and intensity of turbulence. For this it is necessary to define an effective critical Richardson number from the condition of energy balance in a layer 14,000 ft deep and centered on the level of turbulence. The modified index so obtained defines the Jindivik index (J.I.). The average profile of J.I. shows a sharp drop from positive to negative values just above the turbulence level. In conjunction with the mean profiles of wind shear and static stability this suggests that CAT of aeronautical significance represents a vertical convergence of impulses spreading and decaying to smaller scales in a region of reduced static stability. Author

N72-22600# National Climatic Center, Asheville, N.C.

WORLD DATA CENTER A: METEOROLOGY. HIGH ALTITUDE METEOROLOGICAL DATA. VOLUME 7, NO. 5: MAY 1970

1972 227 p refs

Avail: SOD $3.00

Wind and temperature measurements from all available meteorological sounding rocket firings are presented, along with computed values for pressure, density, and speed of sound. Local radiosonde observations nearest the time of firing are included. Statistical tables and graphs of current month means and standard deviations for all parameters with long-term means are also included. Author

N72-22601# National Climatic Center, Asheville, N.C.

WORLD DATA CENTER A: METEOROLOGY. HIGH ALTITUDE METEOROLOGICAL DATA. VOLUME 7, NO. 6: JUNE 1970

1972 241 p refs

Avail: SOD $3.00

Wind and temperature measurements from all available meteorological sounding rocket firings are presented, along with computed values for pressure, density, and speed of sound. Local radiosonde observations nearest the time of firing are included. Statistical tables and graphs of current month means and standard deviations for all parameters with long-term means are also included. Author

N72-22602# National Inst. of Radiological Sciences, Chiba (Japan).

RADIOACTIVITY SURVEY IN JAPAN

May 1971 18 p

(NIRS-RSD-31) Avail: AEC Depository Libraries

Meteorological data are presented in the form of tables showing monthly deposits of Cs-137 and Sr-90 from rain and fallout dusts and a map is presented to show sampling stations. Dietary data for Cs-137 and Sr-90 are also tabulated to show content of vegetables from April, 1970, to January, 1971, and content of tea from May to August, 1970. Source water from 25 sampling locations was analyzed for Cs-137 and Sr-90 and results obtained from April, 1970, to March, 1971, are tabulated. A table is also presented to show content of potable rain water used by lighthouses from May, 1970, to January, 1971. Concentrations of Cs-137 and Sr-90 in marine fish are tabulated for November, 1966, to November, 1970. NSA

N72-22603# Federal Aviation Administration, Washington, D.C. Systems Research and Development Service.

POTENTIAL ECONOMIC BENEFITS OF FOG DISPERSAL IN THE TERMINAL AREA. PART 2: FINDINGS Final Report

Nov. 1971 360 p refs

(FAA Proj. RD-260-001-01R)

(AD-735214; FAA-RD-71-44-2-Pt-2) Avail: NTIS HC $6.00/MF $0.95 CSCL 04/2

The study was designed to provide estimates of the costs of disruptions (delays, diversions, and cancellations) of aircraft arrivals (landings) associated with a number of Category II and III weather situations, with the emphasis on fog situations, at some of the major air carrier airports in the United States. As such they would be measures of the potential economic benefits the airport users would realize if the adverse effects of these weather situations on aircraft landings were completely eliminated by weather modification and/or electronic and other approach and landing aids. Specifically, the estimates which were developed and are shown in this part of the report are of the costs of disruptions (delays, diversions, and cancellations) of scheduled arrivals (landings) of aircraft of first and second level United States certificated route air carriers in domestic and international passenger service. This part of the report also includes a narrative discussion of the qualifications and limitations of the estimates, conclusions, and a bibliography. Author (GRA)

N72-22604# RAND Corp., Santa Monica, Calif.
GLOBAL CLIMATIC DATA FOR SURFACE 800 MB, 400 MB, JANUARY
C. Shutz and W. L. Gates Nov. 1971 182 p refs
(Contract DAHC15-67-C-0141; ARPA Order 189-1)
(AD-736204; R-915-APPA) Avail: NTIS CSCL 04/2

From selected climatological data sources the January global distribution of pressure, temperature, wind, and moisture is reconstructed for the surface, 800 mb, and 400 mb. These data are supplemented by presentations of the global distributions of cloudiness, evaporation, precipitation, and selected elements of the surface heat balance. All data are presented on a global grid of 4 deg latitude by 5 deg longitude and are given in the form of both tabulated values and machine-analyzed maps.
Author (GRA)

N72-22605# Air Weather Service, Scott AFB, Ill.
PROJECT COLD RAIN Final Report
Robert I. Sax and Ted S. Cress Dec. 1971 51 p refs
(AD-736004; AWS-TR-245) Avail: NTIS CSCL 04/2

The report describes the techniques and results of an Air Weather Service operation aimed at augmenting rainfall in south-central Texas. The Air Force portion of the project, termed COLD RAIN, was conducted in June of 1971 and formed part of a large Texas drought-relief program directed by the Bureau of Reclamation. The primary goal of the COLD RAIN operation was, by seeding super-cooled cumulus clouds with silver-iodide nucleating material, to increase rainfall (over what would have occurred naturally) in as wide a geographical area as possible. A secondary, but very important consideration was to gain as great an understanding as possible about cloud response to seeding in order to refine and improve present-day rain-augmentation techniques.
Author (GRA)

N72-22606# Texas A&M Univ., College Station.
A STUDY OF LOW LEVEL WIND AND TEMPERATURE PROFILES AS A FUNCTION OF STABILITY IN THE SURFACE BOUNDARY LAYER
Morgan G. Williams Oct. 1971 89 p refs
(Contract DAAB07-68-C-0073; DA Proj. 1T0-14501-B-81A)
(AD-736524; TR-3; A/M-Ref-71-7T; ECOM-0073-T-3) Avail: NTIS CSCL 04/2

Log-power wind and temperature profiles obtained from mean hourly data at each of two micrometeorological data collection stations were investigated for stability variations. A random sample of diurnal and seasonal profiles was chosen through selection of four simultaneous 24-hr periods of data from the recorded observations of the two stations (eight 24-hr periods).
GRA

N72-22607# Lincoln Lab., Mass. Inst. of Tech., Lexington.
AIRBORNE SEVERE STORM SURVEILLANCE. VOLUME 2: REPORTS OF WORKING PANELS
James W. Meyer 2 Nov. 1971 278 p refs
(Contract F19628-70-C-0230; ARPA Order 512)
(AD-735321; TN-1970-43-Vol-2; ESD-TR-71-296-Vol-2) Avail: NTIS CSCL 04/2

The volume contains the reports of the Airborne Severe Storm Surveillance Summer Study working panels. These reports represent more detailed discussions in support of both their findings and their recommendations. Reports are included from the following panels: Contemporary operations panel; Meterological panel; Research and novel measurements panel; Radar and radiometry panel; Platform panel.
GRA

N72-22608# Flight Test Research, Inc., Long Beach, Calif.
HYGROSCOPIC SEEDING IN OKLAHOMA, VOLUME 1 Final Report
Paul B. MacCready, Jr. 31 Oct. 1971 45 p refs
(Contract DI-14-06-D-7190)
(PB-205361; REC-14-06-D-7190-1) Avail: NTIS CSCL 04B

In July 1971, because of apparent drought in southwest Oklahoma, a rainfall augmentation program was organized under the direction of the Division of Atmospheric Water Resources Management of the Bureau of Reclamation with funding provided by the Federal Office of Emergency Preparedness. The hygroscopic seeding project part of the overall program is discussed. Seeding flights were accomplished on 10 days during the period from mid-August to early October, with a record wet September for Oklahoma. There is no way to make a valid evaluation of the success of this operational program. The program is described and many of the concepts and factors behind hygroscopic seeding are examined.
Author (GRA)

N72-22609# Naval Postgraduate School, Monterey, Calif.
CALCULATION OF LEVELS OF RELATIVE CONTRIBUTION OF THE CARBON-DIOXIDE CHANNEL RADIANCE FROM TIROS 7 IN THE CASE OF A LARGE-SCALE STRATOSPHERIC WARMING IN JANUARY 1964 M.S. Thesis
Larry Lee Giauque Sep. 1971 62 p refs
(AD-736529) Avail: NTIS CSCL 04/2

A case study of a winter stratospheric warming in the western hemisphere in January 1964 between 60 degrees and 40 degrees north latitudes was conducted. Utilizing TIROS VII radiance data and analyzed height fields, a stepwise regression equation was determined to specify lower stratospheric layer temperatures. These temperatures were used with standard atmospheric temperatures to construct a sounding for use in a radiance computer program. Finally, this computed radiance was compared to regression values to determine if prediction and study of stratospheric warmings are valid and useful.
Author (GRA)

N72-22610# Advanced Technology Labs., Inc., Jericho, N.Y.
A STUDY OF DROPLET SPECTRA IN FOGS Final Report
Paolo Baronti and Sheldon Elzweig Mar. 1971 48 p refs
(Contract F44620-70-C-0007; AF Proj. 9781)
(AD-736054; ATL-TR-161; AFOSR-71-0826TR) Avail: NTIS CSCL 04/2

A dynamical fog model, which explains fog maintenance, is utilized as a basis for the description of the droplet distributions within fog layers. The possible phenomena leading to the observed droplet size distributions are discussed and relationships between these distributions and expected conditions of supersaturation and turbulence in a stationary fog are developed.
Author (GRA)

N72-22611# Environmental Technical Applications Center (Air Force), Washington, D.C.
LISTING OF SEMINARS AVAILABLE AT AWS WINGS
Feb. 1972 32 p
(AD-736452; USAFETAC-TN-72-3) Avail: NTIS CSCL 05/9

The report furnishes a complete listing of the prepared technical seminars at AWS wing headquarters which are available for loan to all AWS units for local presentation. The listing includes the seminar subject, author(where available), number of copies available, period of loan, approximate presentation time, type of illustrative material, and a brief synopsis of the seminar material.
Author (GRA)

N72-22612# Environmental Technical Applications Center (Air Force), Washington, D.C.
A SURVEY OF AVAILABILITY OF HURRICANE/TYPHOON PACKAGES AND ASSOCIATED DATA
Allen R. Meals Jan. 1972 18 p refs
(AD-736451; USAFETAC-TN-72-2) Avail: NTIS CSCL 04/2

The survey outlines the types and format of data available on tropical cyclones. The emphasis is on data packages assembled for individual storms. A list of sources for currently available packages is provided. In addition, a catalog of data archived at National Climatic Center, Asheville, North Carolina, and a bibliography of long-term tropical storm climatology are provided.
Author (GRA)

N72-22613# Naval Weather Service Command, Washington, D.C.
STUDY OF WORLDWIDE OCCURRENCE OF FOG, THUNDERSTORMS, SUPERCOOLED LOW CLOUDS AND FREEZING TEMPERATURES
Nathaniel B. Guttman Dec. 1971 134 p refs Prepared in cooperation with Natl. Oceanic and Atmospheric Administration, Asheville, N. C.
(AD-736321; NAVAIR-50-1C-60) Avail: NTIS CSCL 04/2

The charts presented in this study are the result of an extensive effort to provide naval activities a worldwide summary of the distribution of low level phenomena that directly affect aircraft and marine operations. They are designed to be used as a guide by military planners but people in the fields of scientific research, commerce, agriculture and transportation may also find them helpful. The study includes maps of frequencies of fog, supercooled fog, surface temperatures freezing or below, supercooled stratus and low cumulus, days with thunderstorms and the average height of the freezing level. Author (GRA)

N72-22614# Washington Univ., Seattle. Dept. of Atmospheric Sciences.
TURBULENCE MEASUREMENTS OVER ARCTIC SEA ICE, WINTER 1970
B. Prasad and Alan S. Thorndike Oct. 1971 42 p refs
(Contract N00014-67-A-0103-0007; NR Proj. 307-252)
(AD-736252; SR-11) Avail: NTIS CSCL 04/2

During the winter of 1970 the characteristics of atmospheric turbulence over arctic sea ice were studied. The instrumentation consisted of two cup anemometers, two thermocouples, and a one-dimensional sonic anemometer-thermometer. Approximately 70 hours of data were obtained over a range of stable conditions. Spectra of vertical velocity ($\overline{w^2}$), air temperature ($\overline{T^2}$), and cospectra ($\overline{wT}$) are presented. The effect of increasing stability on the shape of the spectra is examined. Author (GRA)

N72-22615# Air Force Cambridge Research Labs., L. G. Hanson Field, Mass.
PRELIMINARY ATLAS OF 1.0, 0.5, AND 0.1 PERCENT PRECIPITATION INTENSITIES FOR EURASIA
Henry A. Salmela, Norman Sissenwine, and Robert W. Lenhard 7 Oct. 1971 39 p
(AF Proj. 8624)
(AD-736406; AFCRL-71-0527; AFCRL-ERP-374) Avail: NTIS CSCL 04/2

Using preliminary statistical relationships between precipitation intensities averaged over 1-min durations and commonly available monthly climatological tabulations of precipitation, rainfall rates for 1.0, 0.5, and 0.1 percent exceedances were computed for weather stations over Europe and Asia for which monthly totals and frequency of daily precipitation were available for the months of January, April, July, and October. Isolines of intensities were drawn delineating regions of low and high rates for each precipitation frequency. These rates may be used for obtaining calculated-risk design criteria for military equipment and for the evaluation of the probability of operational problems when the intensity of precipitation equalled or exceeded with various low probabilities may be critical. Author (GRA)

N72-22616# Weather Wing (7th), Scott AFB, Ill.
TERMINAL FORECAST REFERENCE FILE, SCOTT AFB, ILLINOIS Final Report
Jan. 1972 81 p refs
(AD-737352) Avail: NTIS CSCL 04/2

The reference file discusses factors affecting the weather at Scott AFB, Illinois. Included are location and topography weather controls, climatic aids, and special synoptic studies.
Author (GRA)

N72-22617# Air Force Global Weather Central, Offutt AFB, Nebraska.
AFGWC SEVERE WEATHER VERIFICATION
Arthur Bidner 15 Sep. 1971 18 p
(AD-737031; AFGWC-TN-71-1) Avail: NTIS CSCL 04/2

The note explains the purpose, data input, mechanics, and interpretation of AFGWC service weather verification. It illustrates some of the problems associated with the uniqueness and complexity of severe weather verification, and includes a sample of results. Author (GRA)

N72-22618# TRW Systems Group, Redondo Beach, Calif.
TROPICAL CYCLONES Final Report, 19 Apr. 1971 - 19 Feb. 1972
Paul Dergarabedian and Francis E. Fendell Feb. 1972 95 p refs
(Contract DAHC04-71-C-0025; ARPA Order 1786)
(AD-737016; TRW-18524-6001-R001-Rev-1) Avail: NTIS CSCL 04/2

After a brief presentation of the salient observational facts about tropical cyclones, the two principal models for the cyclone-scale structure and maintenance of the quasisteady mature stage are described-the older model by Riehl and Malkus and the recently developed model by Carrier. One point of disagreement between the two models is that Riehl and Malkus postulate that greatly augmented sea-to-air transfer of latent and sensible heat is required to sustain a hurricane, while Carrier states that because the storm convects a large mass of warm moist air with it, the local sea-to-air transfer of total enthalpy is about the same whether a hurricane is present or not.
Author (GRA)

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N72-22619* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MAGNETIC POSITION DETECTION METHOD AND APPARATUS Patent
John V. Foster, inventor (to NASA) Issued 30 Nov. 1971 17 p Filed 20 Jun. 1969 Supersedes N70-12611 (08 - 02, p 0322)
(NASA-Case-ARC-10179-1; US-Patent-3,624,598; US-Patent-Appl-SN-835058; US-Patent-Class-340-26; US-Patent-Class-244-114) Avail: US Patent Office CSCL 17G

A method and apparatus for establishing the position of an aircraft or other vehicle with reference to a predetermined set of coordinates is described. Magnetic fields are generated by long linear conductors and magnetic dipole means and the ratio of the fields created is measured at a given point to determine the distance between the sources and the given point. The electrical signals obtained by the apparatus are used to provide a visual display of the relative position of an aircraft to the runway upon which it is to land and/or a visual or audible indication of the aircraft's position relative to a predetermined glide slope.
Official Gazette of the U.S. Patent Office

N72-22620*# Litchford Systems, Northport, N.Y.
BROADCAST CONTROL OF AIR TRAFFIC Quarterly Report
George Litchford Mar. 1972 65 p refs
(Contract NASw-2247)
(NASA-CR-126157; QPR-3) Avail: NTIS CSCL 17G

Applications of wide range broadcast procedures to improve air traffic control and make more airspace available are discussed. A combination of the Omega navigation system and the very high frequency omnirange (VOR) is recommended as a means for accomplishing improved air traffic control. The benefits to be derived by commercial and general aviation are described. The air/ground communications aspects of the improved air traffic control system are explained. Research and development

programs for implementing the broadcast concept are recommended. P.N.F.

N72-22621# Advisory Group for Aerospace Research and Development, Paris (France).
GUIDANCE AND CONTROL DISPLAYS
Feb. 1972 237 p refs Presented at 13th Meeting of Guidance and Control Panel of AGARD, Paris, 19-21 Oct. 1971
(AGARD-CP-96) Avail: NTIS

Conference papers are presented on guidance and control display design for aerospace vehicles. The particular areas of investigation are visual criteria, workload criteria, validation of design criteria, VTOL aircraft displays, displays for specific applications, new technology, and testing and evaluation of displays. For individual titles, see N72-22622 through N72-22644.

N72-22622# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. Flight Deck Development Branch.
THE STATUS OF HUMAN PERCEPTUAL CHARACTERISTIC DATA FOR ELECTRONIC FLIGHT DISPLAY DESIGN c05
Keith T. Burnett *In* AGARD Guidance and Control Displays Feb. 1972 10 p refs (See N72-22621 13-21)
Avail: NTIS

The human factors literature was searched and analyzed for human perceptual characteristic data relating to the design of individual electronic flight displays. Some of the more interesting data obtained are summarized and include flicker, visual acuity, display resolution, luminance, alphanumeric legibility, scale legibility, information coding, display size, and the effect of environmental variables on these quantities. Wherever possible the data are analyzed and presented so as to point out significant variables and data trends not specifically discussed in the original works. Author

N72-22623# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. for Flugfuehrung.
A LIMITED STUDY OF THE TRADE OFF BETWEEN LUMINANCE AND COLOR CODING IN ELECTRONIC AIRCRAFT DISPLAYS c09
Ralf Beyer *In* AGARD Guidance and Control Displays Feb. 1972 9 p refs (See N72-22621 13-21)
Avail: NTIS

The effectiveness of luminance and color coding are compared as means for coding display elements in electronic displays. First a review of some past investigations is given. Next some experiments are described which contain an immediate-response task, a single-axis tracking experiment with discontinuous secondary task, tachistoscopic experiments, and the exploration of subjective judgements on different types of color coding in an experimental electronic display. In these experiments the only variable is the type of coding (luminance or color) used for the display elements and the various responses obtained are discussed. Author

N72-22624# Human Engineering Labs., Aberdeen Proving Ground, Md.
WHAT COLOR DISPLAY ELEMENT c05
John A. Barnes *In* AGARD Guidance and Control Displays Feb. 1972 11 p refs (See N72-22621 13-21)
Avail: NTIS

The results are presented of research directed toward determining the best possible colors to use for the elements of a multicolored aircraft display to insure a minimum number of instrument reading errors. A survey of the American manufacturers of multicolored mechanical aircraft displays provided a list of nine colors generally used as background colors and a like number of generally used pointer colors. An integrally illuminated test instrument was built which had the capability of presenting to a test subject any of these background and pointer colors in combination. The lighting of the test instrument was controlled at either of two illumination levels for each background color and was available, with this control, as a red lighting system or as a blue-white lighting system. These results provide the instrument manufacturers with twenty pointer and background combinations which can be expected to produce less than a one percent instrument scale reading error, regardless of the lighting system used and at illumination levels as low as .01 foot Lamberts. Author

N72-22625# Litton Systems, Inc., Van Nuys, Calif. Data Systems Div.
THE INTEGRATED COCKPIT PROCEDURE FOR IDENTIFYING CONTROL AND DISPLAY REQUIREMENTS OF AIRCRAFT IN ADVANCED TIME PERIODS c05
John V. Murphy and Bernard S. Gurman (ECOM, Fort Monmouth, N. J.) *In* AGARD Guidance and Control Displays Feb. 1972 7 p refs (See N72-22621 13-21)
Avail: NTIS

An adaptation of the integrated cockpit research procedure was used to define control and display requirements for the next generation utility transport helicopter under consideration by the U.S. Army. A control and display requirements analysis was conducted based upon the derivation of specific functions necessary for accomplishing four specified missions. Control/display mechanization was derived from specific mission functions. A time-based load analysis was performed utilizing computer processing techniques to make task adjustments in real time and provide a printout of how the tasks in each mission segment could be adjusted to meet the mission requirement. The technique also provided an analysis of contingency situations and denoted overload conditions that occurred. The hard copy mock-up was a full-scale cockpit shell in which the alternative mission control/display configurations could be illustrated. The mock-up contained realistic flight controls and audiovisual projector units that simulated vertical and horizontal situation display formats. Author

N72-22626# Honeywell, Inc., Minneapolis, Minn. Systems and Research Div.
DESIGN IMPLICATIONS OF A BETTER VIEW OF THE MULTICHANNEL CAPACITY OF A PILOT c05
O. H. Lindquist *In* AGARD Guidance and Control Displays Feb. 1972 6 p refs (See N72-22621 13-21)
Avail: NTIS

A major result of a recently completed study is the prediction and measurement of multichannel pilot performance, which significantly increases his information-handling capability beyond that predicted by today's techniques. Current techniques of predicting man/machine interactions were shown to be in error by an order of magnitude in some measurements related to human channel capacity. The results of this experimental work are presented and system design implications for pilot capability and limitations are discussed. Author

N72-22627*# Systems Technology, Inc., Hawthorne, Calif.
SYSTEMATIC MANUAL CONTROL DISPLAY DESIGN
W. F. Clement, D. T. McRuer, and R. H. Klein *In* AGARD Guidance and Control Displays Feb. 1972 10 p refs Sponsored in part by NASA and JANAIR (See N72-22621 13-21)
(NASA-CR-126256) Avail: NTIS CSCL 01D

The principles are outlined of guidance and control display design based on interactions with human psychomotor activity. The inspirations for eye movement studies in flight control and monitoring tasks, and the relationship of eye scanning phenomena to pilot describing functions and remnant are summarized. Several measures of pilot workload in control tasks are discussed. Excess control capacity, in particular, has great promise in quantifying a practical definition of workload. It is a major workload connector with pilot opinion rating and whole-task effective time delay. Further connections with lead equalization, scanning workload, physiological measures of neuromuscular tension, and the effects of additional modalities on visual workload are illustrated. Author

N72-22628# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
A SYMBOL GENERATOR FOR THE ANTHROPOTECHNICAL EVALUATION OF INTEGRATED DISPLAYS c09
K.-F. Kraiss *In* AGARD Guidance and Control Displays Feb. 1972 7 p refs (See N72-22621 13-21)
Avail: NTIS

A freely programmable low-cost high-quality character-generator is described, which uses a hybrid principle of generation. The writing is performed by a combined stroke writing and Lissajous procedure that results in an increased display quality. The binary information needed is stored in a core memory. The applied circuit design enables the writing of a continuous curve, which may be arbitrarily composed of arcs and lines. The presentation of alphanumeric symbols and complex geometric figures is performed using a 15 by 15 dot matrix for construction. Color coding capability is provided by multilayer CRT. Since programming of the displayed picture is done by simple statements on punched tape, the generator becomes an excellent and flexible experimental device for the human engineering evaluation of electronic displays. An example for application is cited. Author

N72-22629# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
A METHOD OF MAN-DISPLAY/CONTROL SYSTEM EVALUATION c05
Ruediger Seifert (British Aircraft Corp., Preston, England), Alan F. Daniels (British Aircraft Corp., Preston, England), and Klaus Schmidt *In* AGARD Guidance and Control Displays Feb. 1972 9 p refs (See N72-22621 13-21)
Avail: NTIS

A method of evaluating the design and assessing the layout of an aircraft cockpit is described. Factors significantly affecting the design, such as scenario, operational, and equipment requirements are introduced and a description of the rig facility provided. The use of the Cooper-Harper rating system, semantic differentials, and guided interviews in the analysis of subject performance and opinion is described. It is concluded that complex man-display/control systems can only be optimized by the adoption of a comprehensive approach to experimental studies. Author

N72-22630*# Massachusetts Inst. of Tech., Cambridge. Man-Vehicle Lab.
INTEGRATED DISPLAY PRINCIPLES AND SOME APPLICATIONS TO V/STOL AIRCRAFT
Laurence R. Young *In* AGARD Guidance and Control Displays Feb. 1972 7 p refs (See N72-22621 13-21)
(Grant NGL-22-009-025)
(NASA-CR-126153) Avail: NTIS CSCL 01D

Design guidelines for pictorial integrated displays are presented, and include the display format and scaling based on expected flight path control requirements. The guidelines are illustrated by the bottom window predictor VTOL display, a perspective glide-slope contact analog V/STOL display, and an airborne air traffic situation display. Author

N72-22631# Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany).
EVALUATION OF AN INTEGRATED FLIGHT DISPLAY FOR THE MANUAL IFR-LANDING OF VTOL AIRCRAFT
H. J. Kornstaedt and J. Pfennigstorf *In* AGARD Guidance and Control Displays Feb. 1972 8 p refs (See N72-22621 13-21)
Avail: NTIS

An integrated flight display for the hovering phase of a VTOL landing was developed. The presentation of information to the pilot is evaluated in simulation by three criteria: landing performance, pilot rating, and measurement of the pilot's mental workload. Adaptation of the display dynamics and the desired landing-profile lead to higher level of performance at a decreased workload. Author

N72-22632# Ministry of Defence, London (England).
V/STOL DISPLAYS FOR APPROACH AND LANDING
David J. Walters and Ralf Beyer (DFVLR) *In* AGARD Guidance and Control Displays Feb. 1972 10 p (See N72-22621 13-21)
Avail: NTIS

The information requirements of a pilot carrying out a V/STOL approach and landing under adverse weather conditions are described, and solutions that were tried out experimentally are analyzed. Among the tentative conclusions are the following: (1) The amount of information needed for V/STOL displays and the independent motion in various axes pose problems in combining and integrating the information channels. It seems possible to combine both a horizontal and a vertical display in one format; the most difficult element to incorporate is the height information. (2) Most current displays were empirically designed without much regard for underlying principles. (3) An optimum cost effective mix of displays and controls appears to involve automatics for inner loop stabilization and displays with manual control for monitoring outer loop control. (4) Techniques of engineering displays for conventional flight appear adequate for V/STOL. Author

N72-22633# Ferranti, Ltd., Edinburgh (Scotland).
A NAVIGATION COMPUTER AND DISPLAY UNIT FOR HARRIER
Thomas S. Briggs *In* AGARD Guidance and Control Displays Feb. 1972 14 p refs (See N72-22621 13-21)
Avail: NTIS

The navigation display and computer for the Harrier strike aircraft is a compact, comprehensive, and self-contained navigation instrument. It contains a pictorial presentation of the navigational situation in the form of a projected moving map, together with the means of storing and selecting the coordinates of a number of destinations or fix points. A variety of numerical information such as latitude and longitude, time-to-go, and ground speed can be selected and displayed optically superimposed on the projected moving map. The display and computer contains all the facilities required for the management of the navigation aspects of the mission profile in one centralized area of the cockpit instrument panel. Particular attention is given to overcoming the viewing problems associated with the use of projected moving map displays in conditions of high ambient lighting, and to providing navigational control and operational facilities which are easy to use in practice. Author

N72-22634# Anacapa Sciences, Inc., Santa Barbara, Calif.
CONTEMPORARY MAP DISPLAYS
James J. McGrath *In* AGARD Guidance and Control Displays Feb. 1972 16 p refs (See N72-22621 13-21)
Avail: NTIS

A general review of developments and capabilities in airborne map display systems is presented. A brief overview of the complicated history of research, development, and operational use is presented first, and then the development of each of four basic types of map displays is traced from its origin to its present status. The four types are: direct-view map displays, projected map displays, combined map/CRT displays, and electronically generated map displays. The main advantages and limitations of each type are noted, and the various ways in which the basic design concepts have been implemented are described. A number of design issues and operational problems of current importance are identified and briefly discussed. Author

N72-22635# Smiths Industries Ltd., Bishops Cleeve (England). Aviation Div.
THE IMPACT OF ADVANCING TECHNOLOGY ON THE EVOLUTION OF ELECTRONIC HEAD-UP DISPLAY SYSTEMS
John H. Smith *In* AGARD Guidance and Control Displays Feb. 1972 10 p (See N72-22621 13-21)
Avail: NTIS

The history of electronic head-up display system as applied to military aircraft is outlined. The various major developments demanded by successive avionic system requirements, and the way in which advancing technology, mainly in the area of components, allows these increasingly stringent requirements to be implemented are discussed. The main emphasis is on the engineering and hardware aspects, and systems fitted to current production aircraft such as the Harrier are discussed. Reference is also made to the most recent developments where computation for weapon delivery, or other purposes, can be provided as an integral facility within the electronics unit. Author

N72-22636# Elliott Flight Automation, Ltd., Rochester (England). Airport Works.
SOME ENGINEERING AND OPERATIONAL FACTORS OF MULTISENSOR DISPLAYS
P. A. Hearne and D. W. Hussey *In* AGARD Guidance and Control Displays Feb. 1972 14 p (See N72-22621 13-21)
Avail: NTIS

The operational advantages of presenting a range of complementary data to the aircrew from which they can make improved deductive judgements is briefly discussed and some operational requirements are outlined. The engineering solutions are shown to favor a raster based display which can accommodate both computed and sensor data in the same format. Methods of display computation and scan conversion associated with this raster technique are described and typical displays produced by these methods are illustrated. Author

N72-22637# Compagnie Generale de Telegraphie sans Fil, Paris (France). Div. des Equipments Avioniques et Spatiaux.
INTEGRAL COMMAND AND CONTROL SYSTEM FOR AIRCRAFT [SYSTEME INTEGRE DE CONTROLE ET DE COMMANDE DES AVIONS]
Marie-Jacques Jullien *In* AGARD Guidance and Control Displays Feb. 1972 12 p In FRENCH (See N72-22621 13-21)
Avail: NTIS

Operating characteristics and techniques are presented for an aircraft integrated command and control system. The system is designed to ease the primary tasks of pilots in the coming years, tasks which have become increasingly difficult due to machine complexity and steadily growing air traffic density.
Transl. by K.P.D.

N72-22638# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
MATERIALS AND TECHNOLOGY FOR NEW INFORMATION DISPLAYS
Patrick M. Hemenger *In* AGARD Guidance and Control Displays Feb. 1972 9 p refs (See N72-22621 13-21)
Avail: NTIS

The current status of electroluminescent materials and devices is reviewed. The limitations of the presently important materials GaP (gallium phosphide) and GaAsP (gallium arsenide phosphide) are discussed, followed by a survey of candidate materials for future display systems. In particular, the potential of groups 2-6 semiconductors is presented along with some recent experimental results. Author

N72-22639# Farrand Optical Co., Inc., Valhalla, N.Y.
A MULTIPURPOSE WIDE FIELD, THREE DIMENSIONAL HEAD UP DISPLAY FOR AIRCRAFT
Joseph A. LaRussa *In* AGARD Guidance and Control Displays Feb. 1972 10 p ref (See N72-22621 13-21)
Avail: NTIS

A system useful to pilots for approach and landing and for navigation is described. Attitude, airspeed, altitude, and spatial location as derived both from analog display which is projected through the windscreen and superimposed on the real world view. The display is a three-dimensional roadway in the sky, down which the aircraft can be flown either for navigation or to a touchdown on the runway. The roadway may also be used to define a holding pattern or even a complete route from takeoff to touchdown. The three-dimensional analog display reduces pilot interpretation time and thereby provides for better aircraft control. Author

N72-22640# Motorola, Inc., Scottsdale, Ariz.
A TRUE 3D OR FLAT 2D DISPLAY
Jordon D. Lewis (Battelle Develop. Corp.) and George P. Walling *In* AGARD Guidance and Control Displays Feb. 1972 6 p refs (See N72-22621 13-21)
Avail: NTIS

A display principle is described for a true 3-D display or a multicolor, solid state, flat panel display. The display volume or surface is a transparent material in which an isolated moving spot is created. Arbitrary 2-D or 3-D figures are generated by rapidly moving the spot in two or three dimensions refreshed at a sufficient rate to eliminate flicker. Data may be entered from conventional sources into the refresh memory, and manual interaction via a movable cursor is possible. The advantages of presenting 3-D information in a true 3-D format are discussed, and applications to display clutter reduction are described. The requirement for a compact, flat panel cockpit display is directly addressed. Author

N72-22641# Singer-Kearfott, Little Falls, N.J.
SPACE TECHNOLOGY APPLICATIONS TO GUIDANCE AND CONTROL DISPLAYS
Joseph Koprowski *In* AGARD Guidance and Control Displays Feb. 1972 11 p refs (See N72-22621 13-21)
Avail: NTIS

Spacecraft displays with their need for small size, low weight, low power consumption, and high reliability have required all solid state digital displays using electroluminescent or light-emitting diode illumination techniques. Advanced integrated circuit electronics, novel mechanical packaging techniques, and high-reliability assurance programs are used in these displays. These technologies, and several existing and other under-development aserospace displays and control units utilizing these technologies are reviewed. Author

N72-22642# Anacapa Sciences, Inc., Santa Barbara, Calif.
UTILITY OF THE VERTICAL CONTACT ANALOG DISPLAY FOR CARRIER LANDINGS: A DIAGNOSTIC EVALUATION
Kenneth D. Cross and Frank R. Cavallero (Naval Missile Center) *In* AGARD Guidance and Control Displays Feb. 1972 11 p refs (See N72-22621 13-21)
(ONR Proj. 0-0077; ONR Proj. 0-0078; ONR Proj. 0-0079)
Avail: NTIS

The accuracy of the pictorial vertical situation display generated by a digital computer was evaluated. Position and attitude errors were measured under each of five experimental conditions, a full-scale simulated carrier landing task and four part-tasks. The part-tasks were designed to assess the degree to which display resolution, temporal loading, and control complexity contribute to total system error. All three attitude parameters were controlled with a high degree of accuracy under all conditions. Control of vertical and lateral position in the full-scale simulation condition was accomplished with about the same accuracy and precision as that reported for actual (day) carrier landings in F-4 aircraft. The part-task data revealed that the largest contributor to lateral error was control complexity, whereas display resolution and temporal loading were found to be large and roughly equivalent contributors to vertical error.
Author

N72-22643# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. Flight Deck Development Branch.
RATE OF CLOSURE AS A PERFORMANCE AS A PERFORMANCE MONITORING PARAMETER
Eldon M. Bobbett and Kenneth R. Woodruff (Sys. Res. Labs., Inc., Dayton, Ohio) *In* AGARD Guidance and Control Displays

Feb. 1972 11 p refs (See N72-22621 13-21)
Avail: NTIS

Surveys on approach and landing accidents revealed the need for rate-of-closure information. Presenting the information and subjecting it to operational criticism were accomplished with a simulation evaluation of a modified Attitude Director Indicator (ADI) incorporating the rate-of-closure information, a two phase flight test evaluation of the same indicator, and a simulation evaluation of a cathode ray tube ADI with rate-of-closure information presented similarly to how it is presented in the electromechanical ADI. The results are explicit in that rate-of-closure information is a requirement in the approach and landing modes and does a good job as a performance monitoring parameter. Author

N72-22644# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. Flight Deck Development Branch.

THE ELECTROLUMINESCENT LIGHTING RESEARCH PROGRAM

David L. Turney and Leroy Addis (Lear Siegler, Inc., Grand Rapids, Mich.) *In* AGARD Guidance and Control Displays Feb. 1972 11 p refs (See N72-22621 13-21)
Avail: NTIS

Experiments flown in a T-39 aircraft by experienced pilots were designed to simulate different types of operational flights by progressively increasing the external visual task loading on the pilot. Both objective measurements and pilot opinion data were obtained on display illumination under external ambient illumination ranging from twilight to night no-moon conditions. Photometric data showed that the pilot's display lighting requirements were influenced by the outside illumination only when this illumination exceeded .001 foot candles. When the night illumination fell below this level, display illumination was primarily influenced by the pilot's preflight dark adaptation; the type of information required for successful mission completion; the priority the pilot placed on the information available; and the effects of cockpit lighting on display legibility. Author

N72-22645*# Israel Program for Scientific Translations, Ltd., Jerusalem.

INTERPLANETARY FLIGHT AND COMMUNICATIONS. VOLUME 3, NO. 9: THEORY ANNALS, BIBLIOGRAPHY, INDEX

Nikolai Alekseevich Rynin 1971 239 p refs Transl. into ENGLISH of the book "Mezhplanetnye Soobshcheniya" Leningrad, Izdatelstvo Akad. Nauk SSSR, 1932 Sponsored by NASA and NSF
(NASA-TT-F-648; TT70-50119) Avail: NTIS CSCL 22A

A description of the paths to be followed by the spacecraft of the future is presented. Some basic information in astronomy is first given, mainly with regard to the Earth, the Moon, and other planets of the solar system. Special charts of the apparent trajectories of the planets and of their orbit in orthogonal projection are shown. These charts clearly demonstrate the intricacies and complexities of navigation of spacecraft in outer space among the complex paths of planets and planetoids. Some calculations relating to spacecraft navigation and velocities are given. A general supplement to the entire series includes an annals and a bibliography of interplanetary travel and a name and subject index. Author

N72-22646# Federal Aviation Administration, Washington, D.C. Aviation Forecast Div.

IFR AIRCRAFT HANDLED FORECAST BY AIR ROUTE TRAFFIC CONTROL CENTER, 1972-1983

Jan. 1972 42 p ref
(Rept-72-00186) Avail: NTIS

Forecasts of IFR aircraft handled by FAA air route traffic control centers (ARTCC) are presented. It serves as an aid to the FAA planning and budget functions in determining future requirements for facilities, equipment, and manpower. Forecasts of aircraft handled in air carrier, general aviation, and military categories are included for Fiscal Years 1972 through 1978 and 1982 and 1983 for ARTCC's in each of the eleven FAA regions. The forecast employs as a base the national forecast of IFR aircraft handled as developed for the FAA report Aviation Forecasts, Fiscal Years 1972-83. Historical trends of each ARTCC are extrapolated and adjustments made for known alterations in center boundaries. Author

N72-22647# National Aviation Facilities Experimental Center, Atlantic City, N.J.

OPERATIONAL EVALUATION OF AN INTERIM LOOP DISPLAY SYSTEM Final Report, Sep. 1969 - Dec. 1971

Howard F. Slattery and Ward McCombs Apr. 1972 25 p
(Proj. 144-170-08X)
(FAA-RD-72-18; FAA-NA-72-12) Avail: NTIS

An operational evaluation to determine the feasibility of using an interim loop display system to display surface traffic movements in blind spot areas was conducted at the J. F. Kennedy Airport. Specific objectives were to (1) determine the reliability of the system, (2) determine the operational utility of the displayed data, and (3) identify and document relevant technical and operational data to assist in determining future design requirements. The interim loop display system consisted of a logic unit, a display unit and a remote control box. A total of 28 magnetic induction loops was imbedded in the surface of the portion of the taxiway that was not visible from the tower. Loop sensors detected passage of vehicles and the information was displayed in the tower cab. It was concluded that the interim loop display system did not provide a reliable display of aircraft or vehicular movement in the blind spot area at the J. F. Kennedy Airport. Author

N72-22648*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

DIGITAL SIMULATION OF CONTINUOUS ERROR MODELS WITH APPLICATION TO AN INSTRUMENT LANDING SYSTEM ERROR

Robert B. Merrick and Gerald L. Smith Mar. 1972 21 p refs
(NASA-TM-X-62116) Avail: NTIS CSCL 17G

A digital simulation of the continuous error of the localized beam of a conventional instrument landing system is discussed. The digital simulation was developed during the analysis of space shuttle navigation capabilities. A discrete mathematical model for use on a digital computer is described. The model generates an output random sequence which is equivalent, for simulation purposes, to the desired random process. The model is a system of difference equations driven by a zero-mean Gaussian random sequence. Author

N72-22649# Lincoln Lab., Mass. Inst. of Tech., Lexington.

ATC SURVEILLANCE/COMMUNICATION ANALYSIS AND PLANNING: TRANSPONDER TEST PROGRAM Final Report

G. V. Colby and E. A. Crocker 12 Apr. 1972 72 p refs
(Contracts DOT-FA72WAI-242; Proj. 034-241-012; F19628-70-C-0230)
(FAA-RD-72-30; ATC-9) Avail: NTIS

Performance parameters of transponders installed in aircraft were measured to determine their degree of compliance with current specifications. A mobile van was outfitted with electronic test equipment which simulated the transmitter and receiver sections of a ground interrogator and which allowed measurement of transponder parameters. A horn antenna located near the aircraft under test was used to couple signals to and from the transponder. The results of measurements on 504 transponders installed in general aviation aircraft, 17 transponders installed in military aircraft, and 28 transponders installed in air carrier aircraft are reported. Of these, 31 general aviation, 2 military, and one air carrier transponders were inoperative. The results of measurements of reply frequency, squitter, delay Mode C operation, dead time, P2/P1 ratio required for suppression, suppression time, framing pulse spacing, power output and sensitivity are included. Author

N72-22650# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
LUNAR ROVING VEHICLE NAVIGATION SYSTEM ALIGNMENT PLAN FOR THE APOLLO 16 TRAVERSES
I. Y. Bar-Itzhack and I. Ben-Harush Mar. 1972 8 p ref
(TAE-149) Avail: NTIS

An error analysis of the Lunar Roving Vehicle (LRV) Navigation (NAV) System was carried out for the update of the Descartes traverses that were being considered for Apollo 16 mission. The objective of this analysis was to determine the NAV system gyro realignment plan along the three traverses such that the maximum position error on each traverse will not exceed 600 meters. Following the gyro performance on Apollo 15 a gyro drift rate of 5 degrees per hour was used in this analysis. The realignment plan which resulted from this analysis is: (1) no realignment is necessary on the first traverse, (2) one realignment is necessary on the second traverse, and (3) one realignment is also necessary on the third traverse. Author

N72-22651*# Systems Technology, Inc., Hawthorne, Calif.
DETERMINATION OF ILS CATEGORY 2 DECISION HEIGHT WINDOW REQUIREMENTS
Walter A. Johnson and Roger H. Hoh Washington NASA May 1972 69 p refs
(Contract NAS2-4892)
(NASA-CR-2024; TR-182-4) Avail: NTIS CSCL 01E

A method for determining the appropriate longitudinal and lateral decision height dispersion limits for any airplane/control system combination during an instrument landing approach is presented. An example is worked out to clarify the steps required. It is shown that the current longitudinal decision height dispersion limits are well suited for a DC-8 with the example control system, but that the lateral limits are too loose to guarantee acceptable touchdowns with the example system subjected to recommended wind and shear disturbances. Author

N72-22652*# Systems Technology, Inc., Hawthorne, Calif.
DEVELOPMENT OF APPROACH CONTROL SYSTEM REQUIREMENTS WITH APPLICATIONS TO A JET TRANSPORT
Duane T. McRuer and Walter A. Johnson Washington NASA May 1972 67 p refs
(Contract NAS2-4892)
(NASA-CR-2023; TR-182-3) Avail: NTIS CSCL 01E

The development of requirements for an approach control system and example applications to a jet transport aircraft are presented. The material is divided into a general discussion of approach control requirements, and a specific application resulting in the design of three alternative longitudinal controllers. The point of view taken is that the essential features of the system structure are the feedbacks themselves, their equalization, and their combinations to create control commands. Use is made of the fact that for successful systems the possible feedback structures are very limited. They derive primarily from guidance, control, and regulation demands; and secondarily from dynamic response characteristics desired by the pilot. From the systems view it is the satisfaction of these requirements that is important rather than the means automatic, manual, or hygrid manual/automatic approach systems. Author

N72-22653# Transportation Systems Center, Cambridge, Mass.
THE ILS SCATTERING PROBLEM AND SIGNAL DETECTION MODEL
G. Chin, L. Jordan, D. Kahn, and S. Morin Feb. 1972 105 p refs
(DOT-TSC-FAA-72-7) Avail: NTIS

The construction of a mathematical model of the instrument landing system (ILS) multipath problem has been undertaken. The theoretical basis for any such model, a critique of previous models and newly achieved developments in ILS model construction are presented. Author

N72-22654*# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).
INERTIAL NAVIGATION SYSTEM USING THREE TDF GYROSCOPIC SENSORS NOT JOINTLY MOUNTED ON A STABLE PLATFORM
Bernhard Stieler (DFVLR, Brunswick) Brunswick DFVLR 1971 103 p refs Sponsored by NASA
(NASA-CR-126358; DLR-FB-71-94) Avail: NTIS; DFVLR, Porz: 21 DM CSCL 17G

An inertial navigation system is described and analyzed based on two two-degree-of-freedom Schuler-gyropendulums and one two-degree-of-freedom azimuth gyro. The three sensors, each base motion isolated about its two input axes, are mounted on a common base, strapped down to the vehicle. The up and down pointing spin vectors of the two properly tuned gyropendulums track the vertical and indicate physically their velocity with respect to inertial space. The spin vector of the azimuth gyro is pointing northerly parallel to the earth axis. The system can be made self-aligning on a stationary base. If external measurements for the north direction and the vertical are available, initial disturbance torques can be measured and easily biased out. The error analysis shows that the system is practicable with today's technology. Author (ESRO)

N72-22655# TRW Systems Group, Redondo Beach, Calif.
NUCLEAR INSTRUMENT LANDING SYSTEMS Phase 1 Final Report, Sep. 1970 - Jun. 1971
R. A. Kaminskas 2 Oct. 1971 110 p refs
(Contract AT(04-3)-828)
(SAN-828-1) Avail: NTIS

Development of the nuclear instrument landing system for providing highly accurate aircraft position information during the last phases of descent and touchdown is described. The system consists of beacons of radioisotope gamma sources which are permanently installed at the airport and airborne equipment which consists of scintillation detectors and associated electronics. Author (NSA)

N72-22656# European Space Research and Technology Center, Noordwijk (Netherlands).
SPIN RESONANCE AND PASSIVE SPIN CONTROL OF MAGNETICALLY STABILISED SATELLITES. PART 2: ANALYSIS OF NONLINEAR PARAMETRIC RESONANCE
R. Kammueller Paris ESRO Mar. 1970 58 p refs
(ESRO-TR-6-ESTEC-PT-2) Avail: NTIS

The numerical analysis of the steady-state spin motion and to the analysis of the spin resonance modes is described. An algorithm has been developed which enables the Fourier coefficients of the periodic resonance oscillations to be computed. The method makes use of the perturbation technique developed by N. N. Bogolyuboff and Y. A. Mitropolskii, in Russian literature known as the method of asymptotic approximation. The unperturbed spin equation, which represents the nucleus of the perturbation scheme, is given the form of the classical Hill equation. The solutions of Hill's equation are known and tabulated. With help of these solutions the asymptotic approximation of the nonlinear spin equation can be constructed. Application of the steady-state conditions leads to a system of algebraic equations which finally determine the Fourier coefficients of the resonance oscillation. The critical resonance parameter is the inertial cross-coupling factor delta. The amplitude characteristic or resonance curve is defined as the relation between the basic amplitude of the resonance oscillation and the parameter. The mathematical formalism for the calculation of these resonance curves has been derived for fractional order resonance of order rho/2 and rho/4. The algorithm for the numerical calculations has been summarized. A description of the computer program DAMP which was used to compute the amplitude characteristics of the spin-resonance modes is given.
Author (ESRO)

N72-22657# Lincoln Lab., Mass. Inst. of Tech., Lexington.
AIR TRAFFIC CONTROL Quarterly Technical Summary, 1 Aug. - 31 Oct. 1971

Herbert G. Weiss 15 Nov. 1971 13 p
(Contract F19628-70-C-0230; AF Proj. 649L)
(AD-735322; ESD-TR-71-303) Avail: NTIS CSCL 17/7

Contents: ATC radar beacon system development; MTI studies; Airborne traffic situation display--Design studies, Display simulation, Cost benefit analysis; Communications, navigation, and identification system; Microwave landing guidance systems. GRA

N72-22658# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

MODELING OF MAGNETIC HYSTERESIS

J. M. Whisnant, D. K. Anand, V. L. Pisacane, and M. Sturmanis Jan. 1971 90 p refs
(Contract N00017-62-C-0604)
(AD-736147; APL-TG-1147) Avail: NTIS CSCL 22/1

Magnetic hysteresis rods have been used successfully for damping the attitude motions of passively stabilized near-earth satellites. This paper describes the implementation of a model of magnetic hysteresis that is suitable for digital computer simulations of such motions. The model is based on the domain theory of magnetization, which assumes that a shifted rectangular hysteresis loop is associated with each domain. Coefficients used by the model are determined by least-squares fitting data from experimental hysteresis loops. For a type of hysteresis rod commonly in use, it is shown that a simplified version of the model may be used. Results from the theoretical model are compared with experimentally generated loops and show good agreement. Author (GRA)

N72-22659# Tracor, Inc., Austin, Tex.

INVESTIGATION OF ANTENNA DUMPING AS A MEANS OF REDUCING PRECIPITATION INTERFERENCE IN AIRBORNE OMEGA Final Report

O. J. Baltzer Jan. 1972 20 p refs
(Contract DOT-FA67WAI-134)
(AD-736516; T71-AU-9279-U; FAA-RD-72-1) Avail: NTIS CSCL 17/7

Omnidirectional E-field antennas (e.g., whip, blade, and long-wire antennas) have various practical advantages over crossed-loop antennas in airborne Omega; however, experience has shown that E-field antennas are much more susceptible to precipitation static. The author has proposed that the interference effects of p-static upon E-field antennas might be reduced by periodically discharging (dumping) any accumulated voltage present on the antenna. The duration of each discharge would be extremely short (typically 0.1 microsecond); on this basis it was hypothesized that the electric field due to propogated electromagnetic signals (Omega) and the electrostatic field associated with p-static would show different recovery characteristics; with the radiative field recovering essentially instantaneously. Author (GRA)

N72-22660# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

MODEL PROBLEM ON THE RESPONSE SPEED AND ACCURACY OF A SATELLITE GRAVITY-GRADIENT STABILIZATION SYSTEM

K. V. Lukanin and V. A. Sarychev 8 Nov. 1971 46 p refs Transl. into ENGLISH from Russian Preprint no. 47, Inst. Prikl. Mat., Moscow, 1971
(Contract N00017-72-C-4401)
(AD-736319; APL-CLB-3-T648) Avail: NTIS CSCL 22/3

The report investigates the attitude performance of an earth orbiting gravity-gradient spacecraft. First the transient response is determined for a system which has damping about one to three orthogonal axes and is in a circular orbit. The characteristic equation is utilized to find optimal values of the spacecraft's adjustable parameters. The transient response is also studied for the separate conditions of eccentric orbit, addition of a constant speed flywheel, and addition of torques due to atmospheric drag. Finally, improvement of the steady state pointing accuracy is considered. Author (GRA)

N72-22661# Control Data Corp., Minneapolis, Minn. Navigation and Space Systems.

AUTOMATED ASTRONOMIC POSITIONING SYSTEM Final Report, 5 Oct. 1970 - 30 Jun. 1971

Joseph E. Carroll 30 Aug. 1971 73 p refs
(Contract F19628-71-C-0036; AF Proj. 7600)
(AD-736421; AFCRL-71-0505) Avail: NTIS CSCL 17/7

The report summarizes design studies, computer simulations, and the design of an Automated Astronomic Positioning System (AAPS). A vertically oriented optical system focuses the zenith star field onto a fixed reticle slit pattern. Earth rotation carries the star field across the reticle, causing star transits past the slits. These are timed and stored in a miniature field computer. A complete astronomic position is computed from these transit times during a site occupation of less than two hours. The necessary equipment is two-man back-pack portable and consists of Sensor Head (optics, slit reticle, photodetectors, level controller, reversal bearing and motor) and Control Unit (4th generation computer, clock, battery power pack, and control panel). GRA

N72-22662# National Aviation Facilities Experimental Center, Atlantic City, N.J.

INVESTIGATE INCOMPATIBILITY BETWEEN GROUND AND AIRBORNE MEASUREMENTS OF VOR SPACE MODULATION Final Report, Jul. 1970 - Mar. 1971

Matthew Naimo, Jr. Feb. 1972 63 p refs
(FAA Proj. 041-305-05)
(AD-737039; FAA-NA-72-18; FAA-RD-71-119) Avail: NTIS CSCL 17/7

The report describes an investigation into the cause of incompatibility between ground and airborne measurements of VOR space modulation when using the latest flight inspection receiver, Fa-4165 3-A. The effort included a survey of the existing procedures and equipment used throughout the FAA, an evaluation of the ground measurement technique, and an evaluation of the airborne measurement technique. The result of the investigation identified problem areas with both the ground and airborne techniques. Author (GRA)

N72-22663# National Aviation Facilities Experimental Center, Atlantic City, N.J.

INVESTIGATE AND ANALYZE DME TRAFFIC LOAD Final Report, Mar. 1970 - May 1971

George J. Hartranft and Harold Postel Feb. 1972 30 p
(FAA Proj. 330-006-07X)
(AD-737038; FAA-NA-72-24; FAA-RD-71-109) Avail: NTIS CSCL 17/7

The report covers the development of a method of measuring DME traffic for both a DME-saturated and non-saturated Tacan site. DME traffic counts were conducted at the following Eastern Region VORTACs: LaGuardia, Robbinsville, Coyle, Kenton, Deer Park, Sea Isle, and Yardley. The LaGuardia VORTAC experienced the highest peak traffic of the VORTACs tested. The LaGuardia traffic count indicates the system is operating at 66 percent of full-load capacity during peak traffic. Author (GRA)

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N72-22664*# Fairchild Hiller Corp., Farmingdale, N.Y.

DESIGN, FABRICATION, AND TESTING OF AN EXTERNAL FUEL (UO2), FULL-LENGTH THERMIONIC CONVERTER Final Report

A. Schock and B. Raab 15 Sep. 1971 166 p refs Prepared for JPL

(Contracts NAS7-100; JPL-952277)
(NASA-CR-126142; FHR-3641A; PCD-TR-71-5; PC004R5101) Avail: NTIS CSCL 18E

The development of a full-length external-fuel thermionic converter for in-pile testing is described. The development program includes out-of-pile performance testing of the fully fueled-converter, using RF-induction heating, before its installation in the in-pile test capsule. The external-fuel converter is cylindrical in shape, and consists of an inner, centrally cooled collector, and an outer emitter surrounded by nuclear fuel. The term full-length denotes that the converter is long enough to extend over the full height of the reactor core. Thus, the converter is not a scaled-down test device, but a full-scale fuel element of the thermionic reactor. The external-fuel converter concept permits a number of different design options, particularly with respect to the fuel composition and shape, and the collector cooling arrangement. The converter described was developed for the Jet Propulsion Laboratory, and is based on their concept for a thermionic reactor with uninsulated collector cooling as previously described. The converter is double-ended, with through-flow cooling, and with ceramic seals and emitter and collector power take-offs at both ends. The design uses a revolver-shaped tungsten emitter body, with the central emitter hole surrounded by six peripheral fuel holes loaded with cylindrical UO2 pellets.

Author

N72-22665*# North American Rockwell Corp., Downey, Calif. Space Div.

SPACE STATION PROGRAM PHASE B DEFINITION: NUCLEAR REACTOR-POWERED SPACE STATION COST AND SCHEDULES

Jan. 1971 286 p
(Contract NAS9-9953)
(NASA-CR-115547; MSC-00744; SD-70-501) Avail: NTIS CSCL 18I

Tabulated data are presented on the costs, schedules, and technical characteristics for the space station phases C and D program. The work breakdown structure, schedule data, program ground rules, program costs, cost-estimating rationale, funding schedules, and supporting data are included. Author

N72-22666*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THE DOPEX CODE: AN APPLICATION OF THE METHOD OF STEEPEST DESCENT TO LAMINATED-SHIELD-WEIGHT OPTIMIZATION WITH SEVERAL CONSTRAINTS

Gerald P. Lahti Washington Apr. 1972 33 p refs
(NASA-TM-X-2554; E-6799) Avail: NTIS CSCL 18I

A two- or three-constraint, two-dimensional radiation shield weight optimization procedure and a computer program, DOPEX, is described. The DOPEX code uses the steepest descent method to alter a set of initial (input) thicknesses for a shield configuration to achieve a minimum weight while simultaneously satisfying dose constaints. The code assumes an exponential dose-shield thickness relation with parameters specified by the user. The code also assumes that dose rates in each principal direction are dependent only on thicknesses in that direction. Code input instructions, FORTRAN 4 listing, and a sample problem are given. Typical computer time required to optimize a seven-layer shield is about 0.1 minute on an IBM 7094-2. Author

N72-22667# Oak Ridge National Lab., Tenn.

LONG-TERM HAZARD OF RADIOACTIVE WASTES PRODUCED BY THE ENRICHED URANIUM, Pu-U-238, AND U-233-Th FUEL CYCLES

M. J. Bell and R. S. Dillon Nov. 1971 23 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3548) Avail: NTIS

An evaluation was made of the long-term hazards of high-level and alpha radioactive wastes generated by irradiation of three fuels representative of those that will be used to generate electrical power in the next several decades. In this evaluation, the composition and radioactivity of the wastes generated by typical LWR, LMFBR, and molten-salt breeder reactors utilizing enriched uranium, Pu-(U-238), and (U-233)-Th fuel cycles, respectively, were computed for times up to 30 million years after discharge. The volumes of water necessary to dilute the various types of high-level waste to the radiation concentration guides (RCG) for ingestion in unrestricted areas were computer as a function of age of the waste. It was found that the volumes required to dilute the three types of waste were similar when evaluated at the same age and exposure.

Author (NSA)

N72-22668# Atomic Energy of Canada, Ltd., Chalk River (Ontario).

MATERIALS RESEARCH IN AECL

Oct. 1971 22 p refs
(AECL-4062) Avail: AEC Depository Libraries; Atomic Energy of Can., Ltd., Chalk River: $0.50

Developments are reported for studies on: radiation synthesis of new and improved materials; development of texture and structure in extruded tubes; extrusion development for nuclear fuels at Chalk River; radiation effects on carbon fibers; radiation damage in semiconductors; and neutron radiography at CRNL. NSA

N72-22669# California Univ., Livermore. Lawrence Radiation Lab.

MAGNETIC MIRROR SYSTEMS

R. F. Post 10 Nov. 1971 49 p Presented at Hearings on Controlled Thermonucl. Res. Conf., Washington, D. C., 10-11 Nov. 1971 Sponsored by AEC
(UCRL-73517; Conf-711127-1) Avail: NTIS

A review is given of the fundamental problems concerning magnetic mirror machines. Prospects for an experimental mirror machine reactor are discussed. The progress to date, problems to be solved, and program steps are outlined. NSA

N72-22670# Bhabha Atomic Research Centre, Bombay (India). Reactor Engineering Div.

NEUTRONICS STUDIES OF TWO 500 MWe Pu-Th AND U-233-Th FAST BREEDER SYSTEMS

V. K. Shukla and S. B. Garg 1971 16 p refs
(BARC-550) Avail: AEC Depository Libraries

The neutronics studies were carried out for two 500 MW(e) fast breeder systems which utilize Pu-Th and U-238-Th metal fuels. The fuel utilization characteristics such as breeding ratio, fuel inventory and doubling times were calculated as a function of the blanket thickness and the core fuel concentration with a thin cladding. The coolant reactivity coefficient was also calculated by removing uniformly 40% of sodium from the core.

Author (NSA)

N72-22671# Los Alamos Scientific Lab., N.Mex.

Pu-238 SPACE ELECTRIC POWER FUEL DEVELOPMENT PROGRAM Quarterly Status Report, 1 Jan. - 31 Mar. 1971

Oct. 1971 16 p refs
(Contract W-7405-eng-36)
(LA-4819) Avail: NTIS

Activities in programs to characterize PuO-Mo cermets (PMC) were continued. Information is included on preparation of feed powder, properties of PMC, and preparation of (Pu-238)O2 powder. NSA

N72-22672# Battelle-Northwest, Richland, Wash.

PACIFIC NORTHWEST LABORATORY DIVISION OF ISOTOPES DEVELOPMENT PROGRAMS Quarterly Report, May - Jul. 1971

J. E. Hansen, comp. Aug. 1971 46 p refs
(Contract AT(45-1)-1830)
(BNWL-1308-7) Avail: NTIS

Activities in a program to develop inexpensive Cs and Sr

sources using Hanford waste are summarized. Research on the radiation characteristics of fission-product Pd-107 is reported, along with an evaluation of applications for fission-product Xe. Work devoted to methods for reducing the Pm-146 content in Pm heat sources is described along with work directed to measurement of radiation doses and biological effects of radioisotopic heat sources for circulatory support systems. Research on development of low-flux imaging in neutron radiography using Cf-252 is reported, along with work on evaluation of thin-film encapsulation of Am-241 alpha photon sources. Development of nuetron techniques for seabed mineral exploration using Cf-252 neutron sources is described. NSA

N72-22215*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

THERMOELECTRIC GENERATOR TEST PROGRAMS AT MSFC

L. E. Young *In its* Res. Achievements Rev., Vol. 4, Report no. 4 Feb. 1972 p 77-96 refs (See N72-22207 13-09)
Avail: NTIS CSCL 18N

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N72-22673* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

OPTICAL SYSTEM SUPPORT APPARATUS Patent

Hubert F. A. Tschunko, inventor (to NASA) Issued 16 Nov. 1971 6 p Filed 13 May 1970 Continuation-in-part of abandoned US Patent Appl. SN-712100, filed 11 Mar. 1968
(NASA-Case-XER-07896-2; US-Patent-3,620,606; US-Patent-Appl-SN-36819; US-Patent-Class-350-310) Avail: US Patent Office CSCL 20F

An optical mirror support system is disclosed having a mirror supported by a number of supporting elements arranged along discrete contact regions. The elements deform the mirror reflective surface in a manner producing a deformation pattern which qualitatively causes a diffraction pattern by the optical aperture, having an idealized or optimized image quality. A preferred or optimized ratio of the distances between adjacent families of support elements and the distance between adjacent support elements of the same family was found.
Official Gazette of the U.S. Patent Office

N72-22674 Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).

CONSIDERATIONS AND RESULTS OF AN INVESTIGATION OF EXISTING NOISE IN THE BRAHMA COMPANY BREWERY AND RECOMMENDATIONS FOR NOISE REDUCTION [CONSIDERACOES E LAUDO PERICIAL REFERENTE AO BARULHO EXISTENTE NAS INSTALACOES DA COMPANHIA CERVEJARIA BRAHMA E CONSIDERACOES SOBRE A INSALUBRIDADE DO AMBIENTE]

L. X. Nepomuceno 22 Oct. 1970 31 p In PORTUGUESE
(Rept-7010.459) Avail: Issuing Activity

The findings concerning the excessive noise levels in the Brahma brewery, Rio de Janeiro are reported. The noise measurements and comparisons of the existing noise levels with the levels established by the Brazilian laws are analyzed in terms of permissible levels. These results are then compared to noise limits established by international organizations. It is recommended that regulations and legislation pertaining to noise levels be based on technical information. Transl. by F.O.S.

N72-22675# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

MEASUREMENT, IN A DUCT, OF THE SPACE-STRUCTURE OF THE DISCRETE-FREQUENCY NOISE GENERATED BY AN AXIAL COMPRESSOR

Patrick Harel and Mariano Perulli 1972 29 p refs Presented at Symp. on Acoustics in Tubular Flows, Southampton, Engl., 10-14 Jan. 1972 Sponsored by SNECMA
(ONERA-TP-1045) Avail: NTIS

A method is described for measuring the spatially coherent and incoherent structures of acoustic modes propagating in a duct, at a given frequency. Data acquisition in the laboratory, analogical signal processing, and numerical processing of the analogical information acquired, based on the fast Fourier transform, are discussed. Results show that in the near field of the fan, the azimuthal structure of the sound field can be partly accounted for by Tyler and Sofrin's model. But other modes are also shown to exist and propagate in the duct, their azimuthal structure being compatible with the propagation properties of the duct. The degree of coherence decreases with axial distance from the source. The dispersion relation of the modes is discussed. Author

N72-22676*# Advanced Technology Center, Inc., Dallas, Tex.

INVESTIGATION OF THE TONE-BURST TUBE FOR DUCT LINING ATTENUATION MEASUREMENT

Arthur R. Soffel and Paul F. Morrow Apr. 1972 158 p refs (Contract NAS1-10021)
(NASA-CR-112031) Avail: NTIS CSCL 20A

The tone burst technique makes practical the laboratory evaluation of potential inlet and discharge duct treatments. Tone burst apparatus requires only simple machined parts and standard components. Small, simply made, lining samples are quickly and easily installed in the system. Two small electromagnetic loudspeaker drivers produce peak sound pressure level of over 166 db in the 3-square-inch sample duct. Air pump available in most laboratories can produce air flows of over plus and minus Mach 0.3 in the sample duct. The technique uses short shaped pulses of sound propagated down a progressive wave tube containing the sample duct. The peak pressure level output of the treated duct is compared with the peak pressure level output of a substituted reference duct. The difference between the levels is the attenuation or insertion loss of the treated duct. Evaluations of resonant absorber linings by the tone burst technique check attenuation values predicted by empirical formulas based on full scale ducts. Author

N72-22677# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.

NUCLEAR MAGNETIC RESONANCE MAGNETOMETRY BY DOUBLE EFFECT ELECTRONIC PUMPING

A. Salvi 18 Mar. 1971 16 p refs In FRENCH Presented at Intern. Conf. on Using the Ocean, Bordeaux, 9-12 Mar. 1971
(CEA-CONF-1770; Conf.-710321-1) Avail: AEC Depository Libraries

A very brief review is given of the base phenomena governing the measurement of weak magnetic fields by the use of nuclear resonance. The concept of polarization is discussed. Its value is proportional to the field to be measured and for 0.5 oersted this coefficient is very small. The increase of the polarization necessary for a precise measurement of the field can be effected by two different methods: prepolarization and dynamic polarization. The concept of double effect polarization arose from the second method. Double effect polarization makes possible an isotropic magnetometer probe insensitive to ambient parasite electromagnetic perturbations. The advantages obtained by the nuclear oscillator are enumerated. Author (NSA)

N72-22678# California Univ., Berkeley. Lawrence Radiation Lab. Dept. of Physics.

PICOSECOND OPTICAL PULSE NONLINEAR PROPAGATION EFFECTS Ph.D. Thesis

Robert Alan Fisher Oct. 1971 150 p refs

(Contract W-7405-eng-48)
(LBL-111) Avail: NTIS

An investigation of the generation, dispersion, and detection of frequency modulated picosecond pulses generated by a mode locked neodymium glass laser, is presented. Efforts were made to: (1) detect sudden changes (with increase in input energy) in the percentage of pulse energy transmission, (2) determine the dependence of fluorescence streak generation on the distance by the pulse passing through a dye solution, and (3) search for light coming from a sample in the photon echo direction after illuminating the sample with echo probing pulses. Negative results were obtained. A detailed description is given of the laser design and setup. E.H.W.

N72-22679# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

MAGNETORESISTIVITY OF DILUTE MAGNETIC ALLOYS

B. Kozarzewshi 1971 13 p refs In RUSSIAN
(JINR-P4-6068) Avail: AEC Depository Libraries

Electron scattering and conductivity in alloys with spin were studied in the presence of a magnetic field. The interaction of conducting electrons with paramagnetic alloys was investigated using a calculation method for thermodynamic Green functions. Only the exchange interaction of electrons was observed, and it is proposed that the Lande factors of electrons and alloys are the same. After several approximations, a basic system of integral equations was solved for a scattering matrix and an expression was obtained for a critical field and magnetic resistivity; this expression is correct in principle for arbitrary temperatures.
Transl. by K.P.D.

N72-22680# Stanford Univ., Calif. Microwave Lab.

DEVELOPMENT OF CHALCOPYRITE CRYSTALS FOR NONLINEAR OPTICAL APPLICATIONS Interim Technical Report, 1 Aug. - 31 Oct. 1971

S. E. Harris, R. L. Byer, and V. L. Donlan Nov. 1971 28 p refs
(Contract F33615-70-C-1640; ARPA Order 1636)
(AD-736018; SU-ML-2024; ITR-5; ITR-5) Avail: NTIS CSCL 20/6

During the first year, the chalcopyrite growth effort was directed at a single compound, DdGeAs2. The potential applications of this crystal in nonlinear optics is now fully evaluated. The report describes the growth of a new chalcopyrite compound CdGeP2, another potentially very useful nonlinear crystal. The choice of CdGeP2 was made after a study of all the II-IV-V2 chalcopyrites, estimating the optical properties from the measured properties of the III-V analogs. The results of this study are included in Appendix I. GRA

N72-22681# IIT Research Inst., Chicago, Ill.

FIBER OPTICS WITH EXTENDED ULTRAVIOLET TRANSMISSION Final Report, 1 Jul. 1967 - 30 Mar. 1971

M. A. Ali and M. A. Schwartz Dec. 1971 68 p refs
(Contract DAAB07-67-C-0542; DA Proj. 1H6-62705-A-055)
(AD-736514; ECOM-0542-F) Avail: NTIS CSCL 20/6

This is the final report under the contract for work performed between 1 July 1967 and 30 March 1971. The objective of this project was to develop and fabricate fiber optic faceplates for cathode ray tubes with a high numerical aperture and high transmission in the near and middle ultraviolet spectral regions. New glasses were developed with the required properties and capable of being fabricated into 5-in. fiber optic faceplates. A lanthanum-zinc-borate core glass having an index of refraction of 1.71 and a peak internal transmission of over 80% at 320 nm (1/2-in. thickness) was developed. A matching potassium-alumina-boro-silicate cladding glass having a low index of refraction, 1.47, was also developed. Fiber optic faceplates, fabricated from these glasses, had a theoretical numerical aperture in excess of 0.8. Six full-size faceplates were fabricated, mounted in metal flanges, and delivered to the Army for incorporation in CRT's.
Author (GRA)

N72-22682# Naval Ordnance Lab., White Oak, Md.

THE APPLICABILITY OF UNDERWATER EXPLOSION SHOCK WAVE REFRACTION DATA TO OCEANIC ACOUSTICS RESEARCH

Robert M. Barash and Jean A. Goertner 15 Dec. 1971 32 p refs
(AD-736602; NOLTR-71-213) Avail: NTIS CSCL 20/1

The report presents a review of the experimental data on the refraction underwater explosion shock waves. For experiments in the ocean and in flooded quarries, pressure-vs-time recordings of the refracted pulses are described, and their characteristics are related to the appropriate regions of the calculated ray diagrams: shadow zones, caustics, single-arrival, and multiple-arrival regions. Although the experiments were directed primarily toward explosive applications, the results are useful for acoustic applications also in that pulse recordings provide clear data on pressure amplification, arrival angle, relative arrival time, and phase shift, for each arrival in a multiple-arrival pulse. Author (GRA)

N72-22683# Naval Ordnance Lab., White Oak, Md.

SOUND TRANSMISSION FROM DEEP TO SHALLOW WATER

R. J. Urick 6 Dec. 1971 43 p
(AD-736608; NOLTR-72-1) Avail: NTIS CSCL 20/1

Using sonobuoys and aircraft, the researchers obtained measurements of sound transmission from deep water to shallow water. The transmission was found to be surprisingly good, both for sound sources on the axis of the deep sound channel, for which a near-optimum bottom slope condition existed, and for shallow sources for which no all-water propagation paths were possible. Author (GRA)

N72-22684# Aerospace Corp., El Segundo, Calif. Aerodynamics and Propulsion Research Lab.

THERMALLY INDUCED STRESS WAVES IN AN ELASTIC LAYER Report for Nov. 1970 - Jul. 1971

Charles Sve and Julius Miklowitz (Calif. Inst. of Tech.) 15 Nov. 1971 40 p refs
(Contract F04701-71-C-0172)
(AD-736436; SAMSO-TR-71-334; TR-0172(2240-30)-3) Avail: NTIS CSCL 20/6

A solution is presented for the stress wave response of a partially transparent elastic layer subjected to electromagnetic radiation. The radiation is assumed to be deposited with a Gaussian spatial distribution in a time short compared with thermal diffusion times. The development is based on the equations of uncoupled dynamic thermoelasticity with heat conduction neglected. Laplace and Hankel transform techniques provide the formal solution and numerical integration of the resulting expressions yields the time-dependent stress distributions in the layer. Several examples are included that illustrate the significance of the dynamic effects and their dependence on the radial coordinate and heating time. Author (GRA)

N72-22685# Aerospace Corp., El Segundo, Calif. Electronics Research Lab.

TELESCOPE PERFORMANCE RECIPROCITY FOR PROPAGATION IN A TURBULENT MEDIUM Final Report, Aug. - Sep. 1971

Harold T. Yura (Optical Sci. Consultants) and David L. Fried 15 Jan. 1972 14 p refs
(Contract F04701-71-C-0172)
(AD-736441; SAMSO-TR-72-5; TR-0172(9230-10)-14) Avail: NTIS CSCL 17/8

The authors demonstrate that, with the effects of atmospheric turbulence included, reciprocity exists between the performance of a telescope (i.e., an antenna) when it functions as part of an optical heterodyne receiver and its performance when it functions as part of a laser transmitter. For a given optical antenna operating through atmospheric turbulence to some distant point, the effect of atmospheric turbulence upon antenna gain is the same whether the antenna is used as part of a laser transmitter.

of an optical heterodyne receiver, or of an image-forming device. It follows that, if the same antenna is used in two or more ways simultaneously, e.g., as a transmitter and as an imaging device, measurements of the performance in one role may be used to gauge the concurrent performance in the other role.
Author (GRA)

N72-22686# Naval Training Device Center, Orlando, Fla.
ANTIREFLECTION THIN FILMS ON TRANSPARENT MEDIA
George Derderian and Denis R. Breglia Feb. 1972 29 p refs
(NTDC Proj. 1714; NTDC Proj. 1714-5)
(AD-736609; NAVTRADEVCEN-TN-24) Avail: NTIS CSCL 11/3

The paper provides a basic knowledge and understanding of thin film technology as it applies to single and multilayer antireflection coatings. A brief history of the subject is given. Derivations of the standard reflectance formulae are outlined from Maxwell's equations to the special cases of integral multiples of quarter wave layers. Practical considerations such as availability of materials, problems in coating, and commercially available facilities are discussed. This paper is designed to serve as a guide to the proper specification of antireflection coatings.
Author (GRA)

N72-22687# Connecticut Univ., Storrs. Dept. of Physics.
PHONON INTERACTIONS IN SOLIDS (THEORETICAL) Final Report, 1 Feb. 1968 - 30 Sep. 1971
Paul G. Klemens Dec. 1971 14 p refs
(Grant AF-AFOSR-1517-68)
(AD-736045; AFOSR-71-3102TR) Avail: NTIS CSCL 20/12

The report describes theoretical studies on high temperature thermal conductivity of non-metallic solids, on the effects of short-range order, dislocations and solute atmospheres around dislocations on the thermal conductivity of alloys, on the pressure dependence of the thermal conductivity and ultrasonic attenuation in dielectric solids, on the scattering of surface elastic waves by surface irregularities, with applications to lunar seismology, on the lifetime of high-frequency phonons, on the thermal conductivity of diamond, and on problems in the electronic structure of alloys.
Author (GRA)

N72-22688# IBM Watson Research Center, Yorktown Heights, N.Y.
SYNTHESIS OF RARE EARTH COMPOUNDS AND STUDY OF THEIR MAGNETIC, OPTICAL AND SEMICONDUCTING PROPERTIES Semiannual Technical Report, 30 Jun. - 31 Dec. 1971
F. Holtzberg, T. R. McGuire, T. Penny, M. W. Shafer, and S. VonMolnar Jan. 1972 38 p refs
(Contract DAAH01-71-C-1313; ARPA Order 1588; IBM Proj 2552)
(AD-736374) Avail: NTIS CSCL 20/12

The authors have explored the EuO system in detail and have correlated the chemical and physical measurements in this classic ferromagnetic semiconducting material. Furthermore, the authors have generalized the findings by extending the studies to other magnetic semiconductors, notably the Th3P4 type gadolinium sulfide and to the extended solid solution system Gd(x)Se(1-x).
GRA

N72-22689# Michigan Univ., Ann Arbor. Cooley Electronics Lab.
UNDERWATER SOUND PROPAGATION IN THE STRAITS OF FLORIDA. THE MIMI LUNAR-CYCLE RECEPTIONS
Raymond L. Veenkant Jan. 1972 158 p refs
(Contract N00014-67-A-0181-0032)
(AD-736229; TR-219) Avail: NTIS CSCL 20/1

The study is part of a continuing program of underwater sound propagation research called project MIMI. The report covers reception and processing and a limited number of analytic comments. The test timing and duration were chosen to allow closer examination of propagation anomalies previously observed during the early winter and to obtain continuous data on an entire lunar-tide cycle (approximately 28 days). The major objectives were to provide data for the design of more extensive experiments and to test the programs and techniques associated with the LINC-8 computer. Signal processing was designed to yield both multipath information and data on anomalous path conditions. The principal success of the study has been in the improvement of processing programs and experiment design.
Author (GRA)

N72-22281*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EFFECTS OF SURFACE CONTAMINATION ON THE INFRARED EMISSIVITY AND VISIBLE-LIGHT SCATTERING OF HIGHLY REFLECTIVE SURFACES AT CRYOGENIC TEMPERATURES
Walter Viehmann and Alfred G. Eubanks *In its* Space Simulation 1972 p 489-502 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 17E

N72-22285*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
ADVANTAGES OF CRYOPUMPING WITH LIQUID HYDROGEN INSTEAD OF HELIUM REFRIGERATORS
J. W. Anderson and J. E. Tueller *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 549-554 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 20L

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N72-22690*# Columbia Univ., New York. Radiation Lab.
RESEARCH INVESTIGATION DIRECTED TOWARD EXTENDING THE USEFUL RANGE OF THE ELECTROMAGNETIC SPECTRUM Progress Report, 1 Jul. 1970 - 30 Jun. 1971
S. R. Hartmann 30 Jun. 1971 117 p refs
(Grants NGR-33-008-012; DA-31-124-ARO(D)-341; DA-ARO(D)-31-124-G972; AF-AFOSR-1454-68; NSF GP-14243; NSF GP-16029; DAAB07-69-C-0383; DA-28-043-AMC-00099(E))
(NASA-CR-126168; CU-6-71-C-0383; PR-21) Avail: NTIS CSCL 20H

The lifetimes and fine structure of He(-) were studied using time-of-flight techniques and quenching by a static axial magnetic field. Using level-crossing spectroscopy the hyperfine constants A and B and the lifetime of the 3 2P3/2 state of Li-7 were measured. Polarization of the Ru 7S level was created as a first step in determining the hyperfine structure of the alkali excited S state. The parametric interaction between light and microwaves in optically pumped Rb-87 vapor were investigated. Measurements and analyses of transitions in formaldehyde and its isotopic species and in the lowest two excited vibrational states of H2CO were also made, as well as of transitions in furan, pyrrole, formic acid, and cyanoacetylene. The Hanle effect was studied in the NO molecule, and RF oscillators were developed with flat, wideband output to observe excited state hyperfine transitions at zero field. Data was generated on the time-dependent behavior of photon echoes in ruby. Stimulated Raman scattering was studied in atomic Tl vapor. A Q switched, temperature-tuned ruby laser was developed which operates between 6934 and 6938 A. The frequency shift due to resonant interaction between identical radiating atoms was calculated.
Author

N72-22691*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SELF-CONSISTENT MANY-ELECTRON THEORY OF ELECTRON WORK FUNCTIONS AND SURFACE POTENTIAL CHARACTERISTICS FOR SELECTED METALS
John R. Smith 1969 36 p refs Presented at Vacuum Sci. Symp., Los Alamos, N. Mex., 28-30 Apr. 1969; Sponsored by Am. Vacuum Soc.
(NASA-TM-X-52547; E-4443) Avail: NTIS CSCL 20H

Electron work functions, surface potentials, and electron number density distributions and electric fields in the surface region of 26 metals were calculated from first principles within the free electron model. Calculation proceeded from an expression of the total energy as a functional of the electron number density, including exchange and correlation energies, as well as a first inhomogeneity term. The self-consistent solution was obtained via a variational procedure. Surface barriers were due principally to many-body effects; dipole barriers were small only for some alkali metals, becoming quite large for the transition metals. Surface energies were inadequately described by this model, which neglects atomistic effects. Reasonable results were obtained for electron work functions and surface potential characteristics, maximum electron densities varying by a factor of over 60. Author

N72-22692*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF MULTIPLE SPIN SPECIES ON SPHERICAL SHELL NEUTRON TRANSMISSION ANALYSIS
Thor T. Semler Washington Apr. 1972 13 p refs
(NASA-TM-X-2546; E-6806) Avail: NTIS CSCL 20H

A series of Monte Carlo calculations were performed in order to evaluate the effect of separated against merged spin statistics on the analysis of spherical shell neutron transmission experiments for gold. It is shown that the use of separated spin statistics results in larger average capture cross sections of gold at 24 KeV. This effect is explained by stronger windows in the total cross section caused by the interference between potential and J(+) resonances and by J(+) and J(-) resonance overlap allowed by the use of separated spin statistics. Author

N72-22693# Research Inst. of National Defence, Stockholm (Sweden).
VACANCY CASCADE SPECTROSCOPY: A CONVENIENT WAY OF STUDYING SPECTRA AND LIFETIMES OF HIGHLY IONIZED ATOMS AND MOLECULES
Peter Erman, Gordon Berry, Lennart Lundin, and Bertic Sigeridsson Feb. 1972 8 p refs Presented at 2d European Conf. on Beam-foil Spectry. and Connected Topics, Lyon, 20-21 Jul. 1971
In Its FOA Rept., v. 6, no. 3
(FOA-4-B-4053-A3; ISBN-91-7056-012-9) Avail: NTIS

Atomic vacancy cascades were created in various gases such as He, N2, O2, CO2, Cl2, Ar, and Xe, using a monoenergetic electron beam (2 to 10 keV, 0 to 10mA). The resulting atomic and molecular spectra were studied in the region 500 to 2500 A, using a grating spectrometer, and proved to be very intense with a broad distribution of charge states. It is shown that this experimental arrangement can easily be used for the determination of atomic and molecular lifetimes if the electron beam is swept in front of the gas volume using a high frequency oscillator. Other features of this light source are also discussed. Author

N72-22694# Tokyo Univ. of Education (Japan). Dept. of Physics.
NON-FORWARD COMPTON SCATTERING AT HIGH ENERGIES
Ichiro Shibasaki, Toshiyuki Minamikawa (Tokyo Univ. of Merchantile Marine), and Tsunetoshi Watanabe (Asia Univ., Tokyo) 1972 11 p refs
(TUEP-72-3) Avail: NTIS

Nonforward Compton scattering was studied at high energies using a Regge model with fixed poles. Comparison was made to experimental data at 8 and 16 GeV. It is shown that proton Compton scattering can be explained by this model. Author

N72-22695*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
MEDIUM-TO-MEDIUM TRANSITION RADIATION AND THE DETECTION OF ULTRARELATIVISTIC CHARGED PARTICLES
Donald E. Robbins and John E. Mack (Houston Univ., Texas) Mar. 1972 11 p refs
(NASA-TM-X-58083; MSC-04565) Avail: NTIS CSCL 20H

The use of X-ray transition radiation to distinguish between protons and positrons of equal rigidity was investigated. A formula for the transition radiation spectrum from a medium-to-medium boundary was derived. The formation zone effect was found to limit the detection of transition radiation from ultrarelativistic particles. Curves showing the results of the spectrum calculations are presented. Author

N72-22696*# NUS Corp., Rockville, Md.
CODE CUGEL: A CODE TO UNFOLD Ge(Li) SPECTROMETER POLYENERGETIC GAMMA PHOTON EXPERIMENTAL DISTRIBUTIONS
J. J. Steyn and U. Born Jul. 1970 146 p refs Prepared for JPL
(Contracts NAS7-100; JPL-953133)
(NUS-692; NASA-CR-126150) Avail: NTIS CSCL 20H

A FORTRAN code was developed for the Univac 1108 digital computer to unfold lithium-drifted germanium semiconductor spectrometers, polyenergetic gamma photon experimental distributions. It was designed to analyze the combination continuous and monoenergetic gamma radiation field of radioisotope volumetric sources. The code generates the detector system response matrix function and applies it to monoenergetic spectral components discretely and to the continuum iteratively. It corrects for system drift, source decay, background, and detection efficiency. Results are presented in digital form for differential and integrated photon number and energy distributions, and for exposure dose. Author

N72-22697# Northeastern Univ., Boston, Mass. Dept. of Physics.
DETERMINATION OF NEUTRAL f MESON NUCLEON NUCLEON AND g MESON NUCLEON NUCLEON COUPLING CONSTANTS
Ronald Aaron and Hyman Goldberg Feb. 1972 17 p refs
(Grant NSF GP-29649)
(NUB-2116) Avail: NTIS

Using backward pion N dispersion relations (BDR) and sum rules derived from BDR, the spin-flip f(0) N N and a combination of the flip and nonflip g N N coupling constants are obtained, and certain backward pion N data are fitted. The results have implications in the one boson exchange theory of the nucleon nucleon force and in theories of elementary particles which assume universal coupling to the stress tensor. Author

N72-22698# Northeastern Univ., Boston, Mass. Dept. of Physics.
ANTIPROTON PROTON ANNIHILATION IN THE MULTIPERIPHERAL REGGE MODEL
Hyman Goldberg Mar. 1972 11 p refs
(Grant NSF GP-21336)
(NUB-2120) Avail: NTIS

Using a simple multiperipheral Regge model, an acceptable fit was obtained for proton-antiproton annihilation data. A Regge analysis was made of the imaginary part of the forward elastic amplitude, including neglect of isospin dependence and assumptions concerning exchange degeneracy. K.P.D.

N72-22699# Rochester Univ., N.Y. Nuclear Structure Research Lab.
[NUCLEAR STRUCTURE RESEARCH AND INSTRUMENTATION] Annual Report, 1971
1971 187 p refs
Avail: NTIS

Research activities at the Nuclear Structure Research Laboratory were in the fields of nuclear shapes, particle transfer reactions, heavy ion reactions, and statistical properties of nuclei. Work was done on multi-nuclean transfer reactions. The beam pulsing system is being used for (He-3,n) measurements and heavy ion fusion studies. Basic studies were carried out on atomic interactions involved in heavy ion collisions and applications to trace element analysis. Author

N72-22700# Northeastern Univ., Boston, Mass. Dept. of Physics.
CURRENT-STRESS TENSOR COMMUTATORS AND WARD IDENTITIES
Robert Perrin Mar. 1972 29 p refs Supported by NSF
(NUB-2122) Avail: NTIS

Model-dependent current stress tensor commutators are determined by requiring that the spatial components of the currents have scale dimension 3, and that the Jacobi identity of J(0) - Theta (00) - Theta (0i) be satisfied up to terms including one derivative of a delta function. Ward identity techniques are then used to study the J(mu) - (nu) - Theta (rho lambda) three-point function. Covariant proper functions are defined by adding seagull terms to the time-ordered products. These seagull terms contribute to the Ward identities for the proper functions, rather than simply cancelling the Schwinger term contributions. A single particle dominance approximation is then used for all spectral functions, and a solution to the Ward identities is obtained. The sigma couplings, implied by the solutions, J(mu) - J(nu) - Theta (rho) sub rho vertex. Author

N72-22701# Illinois Univ., Urbana.
QUANTUM FIELD THEORIES IN INFINITE MOMENTUM. FRAME 2: SCATTERING MATRICES OF SCALAR AND DIRAC FIELDS
Shau-Jin Chang and Tung-Mow Yan (Cornell Univ.) Feb. 1972 39 p refs
(Grant NSF GP-25303)
(ILL-(TH)-72-4-Frame-2) Avail: NTIS

The scattering matrices of field theories formulated in light front quantization were studied. Reduction formulas for scalar and Dirac particles were derived. The scattering matrices in this formulation are shown to give the same predictions as in the equal time formulation to all orders of perturbation. Second order renormalization was also carried out. New Feynman rules of the perturbation theory are given and their characteristics are discussed. Author

N72-22702# Illinois Univ., Urbana.
QUANTUM FIELD THEORIES IN INFINITE MOMENTUM. FRAME 1: QUANTIZATION OF SCALAR AND DIRAC FIELDS
Shau-Jin Chang and Tung-Mow Yan (Cornell Univ.) Feb. 1972 52 p refs
(Grant NSF GP-25303)
(ILL-(TH)-73-3-Frame-1) Avail: NTIS

Renormalizable coupled scalar and Dirac field theories were quantized in equal -x(+) surfaces (called light fronts). Schwinger's action principle was employed to deduce the correct canonical equal -x(+) (anti)-commutation relations. These theories are shown to be Lorentz-invariant. Generalized Schwinger's conditions for a quantum field theory are given and discussed. Spectral sum rules were derived. Leading singularities of Green's functions and products of currents near the light cone were studied and the implications for current algebra sum rules are discussed. Author

N72-22703# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
DIFFRACTIVE PRODUCTION OF NON-STRANGE MESONS IN THE HARMONIC OSCILLATOR QUARK MODEL
A. leYaouanc, L. Oliver, O. Pene, and J. C. Raynal Feb. 1972 28 p refs
(LPTHE-72/7) Avail: NTIS

The quark model harmonic oscillator wave functions, a treatment of recoil which has proven successful for N*'s diffractive production, and a determination of quark spin-flip amplitude from pion N elastic scattering s-channel center-of-mass helicity conservation, are used. There is no fitted parameter except the forward value and slope of the quark quark non-spin-flip elastic amplitude deduced from pion N elastic scattering. Wave function parameters were deduced from meson and baryon Regge slopes. Absolute calculations are made, and predictions specific to the quark model are discussed. Success for A2 (diffractive character, total and differential cross sections, density matrix) is obtained, as it is also for A3 as much as experimental comparison is possible. For A1, agreement for total cross section and diffractive character of the production is found. The Morrison and Carlitz-Frautschi-Zweig selection rules are shown to be rejected by experiment. Author

N72-22704# Laboratoire de Physique Theorique et Particules Elementaires, Orsay (France).
FIXED POLES, UNITARITY AND DUALITY APPLICATION TO PROTON-NUCLEON CHARGE EXCHANGE PHENOMENOLOGY
A. Capella, B. Div (Lab. de Phys. Theorique et Hautes Energies, Paris), and J. M. Kaplan (Lab. de Phys. Theorique et Hautes Energies, Paris) Mar. 1972 49 p refs
(LPTHE-72/8) Avail: NTIS

In some cases the partial wave unitarity relation not only is compatible with the presence of particular fixed poles in the J-plane, but also causes these fixed poles to propagate from one reaction to another. In amplitudes with an exotic s- or u-channel and no Pomeron in the t-channel, duality leads to the equality (up to a sign) of the right and wrong signature fixed pole residues. These results provide a good argument in favor of the presence of some right signature fixed poles in hadronic reactions. In particular the J = 0 wrong signature fixed pole in the pion(-) proton yields pion(0) neutron reaction induces a right signature fixed pole at the same value of J in pn yields np. This fixed pole is a good candidate for the slowly varying background currently considered to explain the forward spike in pn yields np, through a destructive interference with the t-channel pion. A definite distribution of the background among the various amplitudes is required in order to describe the present experimental data, and then a well defined shape is predicted for the forward spike. Author

N72-22705# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
SOME INSIGHT ON QUARK DYNAMICS WITHIN HADRONS
A. leYaouanc, L. Oliver, O. Pene, and J. C. Raynal Feb. 1972 34 p refs
(LPTHE-72/6) Avail: NTIS

In order to get linear trajectories, it was proposed that the harmonic operators should represent the squared mass instead of the Hamiltonian. A modified version based on three-dimensional instead of four-dimensional oscillators is presented. It is interpreted as a law of additivity of squared energies; although not covariant, it is shown to reflect the relativistic motion of quarks. The model generalizes more directly the nonrelativistic oscillator by maintaining a three-dimensional formulation and keeping the original wave functions; a direct link with previous nonrelativistic results is achieved. The right baryon Regge slope is obtained from the wave function radius and the correct omega- and rho-meson absolute electromagnetic decay rate is obtained from the meson Regge slope. Some empirical assumptions of the quark model are justified. The hypercharge breaking of SU(3) comes out quadratic as confirmed by experiment, and a satisfactory ratio is obtained between baryon and meson breaking. Electrostatic and magnetic contributions to electromagnetic baryon mass differences are calculated. Author

N72-22706# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
THE ENDPOINT OF THE ELECTRON SPECTRUM IN MUON-DECAY
P. vanNieuwenhuizen Jan. 1972 17 p refs
(LPTHE-72/5) Avail: NTIS

The well-known endpoint singularity of the electron spectrum in muon decay is removed in a covariant way using the quantum electrodynamics full field theory treatment of infrared divergences. The covariant method simplifies the calculations considerably, and a second simplification is obtained by considering a special lorentz frame. Author

N72-22707# Bonn Univ. (West Germany). Physikalisches Inst.
EVALUATION OF A HELIUM COOLED ION SOURCE WITH SUPERSONIC WIND TUNNEL AND MODEL CALCULATION
H. Lippmann and H. Tatarczyk Munich Bundesministerium fuer Bildung und Wiss. Jan. 1972 58 p refs In GERMAN; ENGLISH summary Original contains color illustrations
(BMBW-FB-W-72-03) Avail: NTIS; ZLDI Munich: 12,20 DM

The advantages and the outlay of a mass spectrometer with helium cooled ion source for use in upper atmosphere research are described. Functional tests have been performed in a supersonic wind tunnel. They have verified the fact, that the shock in front of the cooled front plate of the ion source can be brought to vanish for typical flow conditions of a rocket flight. Furthermore the equation for the density distribution behind an orifice has been extended to a form applicable to this ion source. The spatial density distribution inside the ion source has been calculated numerically. Author

N72-22708# California Univ., Livermore. Lawrence Radiation Lab.
COMPUTATIONAL STUDY OF MAGNETIC SURFACES IN THE MINIMUM-AVERAGE-B LEVITRON WITH NONAXISYMMETRIC PERTURBATIONS
R. Freis 2 Aug. 1971 23 p refs
(Contract W-7405-eng-48)
(UCRL-51104) Avail: NTIS

A computational study is presented of the effect of floating-ring tilt on magnetic surfaces in the levitron. An unperturbed field configuration is considered which is formed by the ring field, a toroidal field, and a vertical field adjusted to form a separatrix with the stagnation point at r/R sub ring = 0.25. Magnetic surfaces are destroyed by ring tilt delta equals 0.1 deg in the region between the separatrix (i = 0) and the surface for which i = 2 pi. Resonant surfaces closer to the ring form regular islands where i/2pi = (n + 1)/2, n = 1 to 5, while nearer the ring where n > 5 essentially no perturbing effect is observed. Islands for n = 0, 1 increase in width as delta sup 1/2 until breakup into ergodic lines occurs by means of secondary island formation. For n = 2 to 5, the island width increases as delta sup 3/2 in contrast with the predicted delta sup 1/2 dependence. The dominant perturbing field is the component directed along the symmetry axis. Author (NSA)

N72-22709# California Univ., Livermore. Lawrence Radiation Lab.
SIGNIFICANCE OF TRITIUM RELEASES TO THE ENVIRONMENT
J. J. Koranda, J. R. Martin, and L. R. Anspaugh 10 Nov. 1971 18 p refs Presented at IEEE 1971 Nucl. Sci. Symp., San Francisco, 3-5 Nov. 1971 Submitted for publication Sponsored by AEC
(UCRL-73546; Conf-711111-23) Avail: NTIS

Tritium introduced into the environment as THO will move through ecological systems in the same manner as stable water. Tritium will enter the hydrologic cycle either via evapotranspiration or the surface bodies of water. Data are reviewed from a number of ecological experiments conducted to determine the movement of tritium in the environment. Field-grown plants were exposed to liquid and vapor THO for periods of one-half and one hour. Tritium concentrations were determined in leaf samples collected after exposure for periods of time up to 45 days. Tritium decays rapidly in the plant species studied and exhibited a three component half-life when plants were exposed to THO vapor. The length of exposure, and sources of THO in the soil affect the half-time of tritium in the plant tissues. Data produced in ecological experiments on tritium movement were used in a theoretical consideration of acute and chronic vapor releases of tritium in an agricultural environment. Author (NSA)

N72-22710# McDonnell-Douglas Astronautics Co., Richland, Wash. Donald W. Douglas Labs.
PLUTONIA/CURIA COMPATIBILITY TESTING Quarterly Report, Jul. - Sep. 1971
R. L. Andelin and J. D. Watrous Oct. 1971 36 p
(Contract AT(45-1)-2138)
(MDC-G-3129; QR-12) Avail: NTIS

Evaluation of plutonia/barrier material/iridium container test combinations after exposure at 1500 C for 1000 hours suggests that the barrier materials tested by eliminated. Hafnia, one of the barrier materials, contributed excess oxygen to the system causing molybdenum to vapor transport to cold surfaces and then react with the iridium. Stoichiometric plutonia appears to have better compatibility with iridium in these complex tests but poorer geometric stability than substoichiometric plutonia. Testing of a plutonia/iridium system is required for substantiation. Further exposure is underway with matched samples and additional noble-metal containers. Results on plutonia molybdenum cermet (PMC)/refractory-alloy double containers exposed at 1500, 1800, and 2000 C were generally confirmed by microhardness measurements. Author (NSA)

N72-22711# Akademiya Nauk SSSR, Novosibirsk. Inst. Yadernoi Fiziki.
PHASE STABILITY OF THE MOTION OF MANY BUNCHES IN CHARGED PARTICLE STORAGE DEVICE
M. M. Karliner 1970 18 p refs In RUSSIAN
(IYAF-45-70) Avail: AEC Depository Libraries

The conditions for phase stability of motion of many clusters were investigated in storage devices for relativistic particles during electromagnetic interaction of a beam with the outer system. For the most characteristic case of identical clusters, the conditions of instability were obtained in the form of a system of inequalities, each of which assures stability for the corresponding symmetrical mode of vibration. The special features of the case of many clusters are analyzed and contrasted with a single cluster. A formula is offered for increments of instability of symmetrical modes. Author (NSA)

N72-22712# Institut Atomnoi Energii, Moscow (USSR).
LIFETIME OF IONS IN THE TOKAMAK-3 DEVICE
L. A. Artsimovich, E. P. Gorbunov, and M. P. Petrov 1970 8 p refs In RUSSIAN
(IAE-2032) Avail: AEC Depository Libraries

The energy and lifetime of ions were calculated for the central zone of a plasma filament in the Tokamak-3 device. Calculations were based on the ion temperature from an analysis of charge transfer in atomic spectra and on the results of plasma density measurement by a microwave interferometer. An essential fraction of heat is lost by ions through conductivity. Not over 20% of the total heat loss occurs through diffusion and charge transfer in the near-axial regions of the plasma filament in Tokamak-3. Author (NSA)

N72-22713# California Univ., Livermore. Lawrence Radiation Lab.
CAVITY DECOUPLING OF NUCLEAR EXPLOSIONS
Howard C. Rodean 2 Aug. 1971 33 p refs
(Contract W-7405-eng-48)
(UCRL-51097) Avail: NTIS

The physical phenomena of nuclear explosions in air and in rock are described, and it is shown that the more rapid inelastic

stress-wave attenuation in air makes possible cavity decoupling. The mathematical theory of elastic-wave radiation is outlined, with emphasis on the frequency-dependence of the elastic-wave spectra on cavity geometry. Definitions are given for tamped, partially-decoupled and fully-decoupled explosions. Five different criteria for full decoupling are described; one is exact and the other four are approximations which are expressed in terms of simple mathematical formulas. One criterion is well known and probably conservative in practice, and another is recommended for use with cavities in strong salt. The recommended criterion is that the post-explosion cavity pressure be equal to or less than the overburden pressure. Author (NSA)

N72-22714# Rome Univ. (Italy). Inst. of Physics.
SUFFICIENT CONDITIONS FOR SATURATION OF NUCLEAR FORCES
F. Calogero, Y. A. Simonov (Inst. of Theoret. and Exptl. Phys., Moscow), and E. L. Surkov (Kurchatov Inst. of Atomic Energy) 17 Nov. 1971 11 p refs Submitted for publication Sponsored by Ist. Nazl. di Fis. Nucl.
(Nota-Interna-341) Avail: NTIS

The extension of Wigner's theorem to a static nuclear force having a more general exchange character is reported. The treatment requires the use of group-theoretical results but the proof is not given. A set of saturation conditions is given that have the advantage of being applicable also to nuclear interactions characterized by potentials that are different for each spin isospin state, and that may change sign. A second set of saturation conditions is derived using the technique of Fisher and Ruelle. The two types of sufficient conditions for saturation reported are not completely overlapping. ESRO

N72-22715# Rome Univ. (Italy). Inst. of Physics.
NONLINEAR LEE MODEL
F. Calogero 17 Nov. 1971 13 p refs Submitted for publication
(Nota-Interna-340) Avail: NTIS

The model characterized by the Hamiltonian H = H sub o + f(H sub I), where f(x) is a largely arbitrary (real) function, and H sub o and H sub I are the free interaction parts of the Hamiltonian of the usual Lee model, is solved exactly in one sector of its Hilbert space. The solutions resemble, but are somewhat richer than, the corresponding solutions of the usual Lee model. ESRO

N72-22384# Imperial Coll. of Science and Technology, London (England). Dept. of Physics.
LOW-FREQUENCY INTERACTIONS
D. J. Southwood *In* ESRO The ESRO Geostationary Magnetospheric Satellite Mar. 1971 p 101-106 refs (See N72-22377 13-13)
Avail: NTIS

N72-22385# Imperial Coll. of Science and Technology, London (England). Dept. of Physics.
THE EFFECT OF RESONANT INTERACTIONS ON OBSERVED FLUX
J. W. Duncey and D. J. Southwood *In* ESRO The ESRO Geostationary Magnetospheric Satellite Mar. 1971 p 107-110 refs (See N72-22377 13-13)
Avail: NTIS

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N72-22716# Nagoya Univ. (Japan). Inst. of Plasma Physics.
NONLINEAR MAGNETOSONIC WAVES IN A TURBULENT PLASMA
Jun-ichi Sakai Jan. 1972 23 p refs
(IPPJ-118) Avail: NTIS

Nonlinear magnetosonic waves in a turbulent plasma, characterized by an effective electrical conductivity due to microinstabilities, are governed by the Burgers type equation, which has a shock-like stationary solution. It is shown that initial magnetic pulses of Gaussian and solitary wave forms first decay due to dissipation, and subsequently form a shock front whose steepness is determined by the opposing effects of nonlinearity and dissipation. This process is thought to be important in connection with shock formation in space plasmas. Author

N72-22717*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
VLASOV EQUATION EIGENVALUES AND EIGENVECTORS FOR FOURIER-HERMITE DISPERSION MATRICES OF ORDER GREATER THAN 1,000
Frederick C. Grant Washington Apr. 1972 23 p refs
(NASA-TN-D-6677; L-8141) Avail: NTIS CSCL 12A

The connection between the Van Kampen and Landau representations of the Vlasov equations has been extended to Fourier-Hermite expansions containing more than 1000 terms by taking advantage of the properties of tridiagonal matrices. These numerical results are regarded as conclusive indications of the nonuniformly convergent behavior of the approximation curve in the limit of an infinite number of terms and represent an extension of work begun by Grant (1967) and by Grant and Feix (1967). Author

N72-22718*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A COMPARISON OF COUPLING EFFICIENCIES FOR A STIX COIL AND AN m EQUALS 1 COIL
Donald R. Sigman Washington Apr. 1972 16 p refs
(NASA-TM-X-2547; E-6758) Avail: NTIS CSCL 20I

This theoretical and experimental study compares the ion-cyclotron wave generating characteristics of a Stix coil (which generates waves with azimuthal mode number m = 0) with those of a coil which produces primarily m = + or -1 ion-cyclotron modes. The theoretical work of J.E. Hipp, which predicted very good coupling for the m = 1 coil, was extended to determine the scaling laws for plasma column radius and coil wavelength. Experimentally, an m = 1 coil and an m = 0 coil were used to generate ion-cyclotron waves on a beam generated plasma column with electron density = 10 to the 12th power/cu cm. Coupling resonances with peak efficiencies of approximately 40 to 50 percent were measured for both coils in low power (approximately 10k W) experiments. For equal power transfer to the plasma, the m = 0 coil voltage was more than a factor of two greater than that for the m = 1 coil. Author

N72-22719# Nagoya Univ. (Japan). Inst. of Plasma Physics.
TRAPPED-ION INSTABILITIES IN ION-ACOUSTIC WAVE
H. Ikezi, Y. Kiwamoto, K. Nishikawa, and K. Mima Feb. 1972 34 p refs
(IPPJ-120) Avail: NTIS

Growth of two types of sideband waves were observed experimentally. This occurs when a relatively large amplitude ion-acoustic wave propagates in a collisionless plasma having the electron-to-ion temperature ratio (T sub e)/T sub i about equal to 20. Trapped particle instability theory accounts for the frequency spectrum, and frequency and amplitude ranges of the large amplitude wave, where the sideband waves grow, as well as their growth rates. The sidebands extract the energy from the large amplitude wave and cause heavy damping. Author

N72-22720# Akademiya Nauk URSR, Kharkov. Fiziko-Tekhnicheskii Inst.
INVESTIGATION OF PLASMA HEATING IN A STRONG

VARIABLE ELECTRIC FIELD
L. I. Grigoreva, V. L. Sizonenko, B. I. Smerdov, K. N. Stepanov, and V. V. Chechklin 1970 41 p refs In RUSSIAN
(KHFTI-70-64) Avail: AEC Depository Libraries

Scattering of charged particles by turbulent pulsation of an electric field leads to effective heating of plasma. The experiments showed that, during turbulent heating of plasma by fast magneto-acoustic waves, preferential heating of ions was correlated with small amplitudes, while at large amplitudes both electrons and ions were heated. The plasma was created by 18-microsecond pulse discharges with oscillating electrons in hydrogen. Measurement of the longitudinal energies of electrons and ions emerging from the plasma along a fixed magnetic field was accomplished with the aid of a three-network analyzer with retarding potential. Observations were also made on the instability of plasma with a transverse current, heating of electrons in the field of a turbulent plasma, and ion heating. NSA

N72-22721# Paris Univ. (France).
PROPAGATION OF FREQUENCY-MODULATED ELECTROMAGNETIC WAVES THROUGH COLD PLASMAS: ASSOCIATED NONLINEAR EFFECTS Ph. D. Thesis [ETUDE DE LA PROPAGATION D'ONDES ELECTROMAGNETIQUES MODULES EN FREQUENCE DANS LES PLASMAS FROIDS: EFFETS NON LINEAIRES ASSOCIAS]
Jean-Daniel Allanche 1970 117 p refs In FRENCH
(FRNC-TH-118) Avail: AEC Depository Libraries

The nonlinear response of a plasma to a frequency modulated electric current (nonpropagative case), and the nonlinear phenomena associated with the propagation of a modulated electric wave are analyzed (propagative case). The electric field consists of two superimposed fields, only one of them being frequency-modulated. In order to establish the expression for the electron current density in the nonpropagative case, stationary solutions are assumed; they are expanded in multiple Fourier series. The induced electric current demonstrates the effects of disymmetry in the modulated signal (self-modulation) and of crossed modulation (generation of harmonics). In the propagative case, the Boltzmann equations enable the isotropic and anisotropic components to be determined, these functions depending upon the position vector. The collision frequency intervenes in the various expressions for the conductivities, (both isotropic and anisotropic). The results obtained confirm the importance of the electron-molecule interaction law in explaining the macroscopic phenomena. Physical and experimental applications are envisaged (new method of diagnostics). NSA

N72-22722# Institute of Nuclear Research, Warsaw (Poland).
COMMENTS OF POPULATION DENSITIES AND IONIZATION EQUILIBRIUM IN TWO TEMPERATURE PLASMA
Szymon Suckewer and Andrzej Skorupski 1971 4 p refs Submitted for publication
(INR-P-1335) Avail: AEC Depository Libraries

Reasons for the discrepancies between results concerning population densities and ionization equilibrium in a hydrogen plasma are discussed. An analytic formula for population densities, valid also in nonequilibrium situations, is given.
Author (NSA)

N72-22723# Commissariat a l'Energie Atomique, Saclay (France). Centre D'Etudes Nucleaires.
HYDRODYNAMIC DESCRIPTION OF A PLASMA SUBJECTED TO A MAGNETIC FIELD: THE GRANULE LASER PROBLEM [DESCRIPTION HYDRODYNAMIQUE D'UN PLASMA SOUMIS A UN CHAMP MAGNETIQUE: LE PROBLEME GRANULE-LASER]
Jean-Paul Bayard, Jean-Paul Boujot, and Jean-Louis Soule Aug. 1971 61 p refs In FRENCH
(CEA-N-1470) Avail: AEC Depository Libraries

An attempt is made to simulate a real physical experiment: the problem of the spatio-temporal evolution in a magnetic field of a plasma obtained by the total ionization of a H-Li granule under the action of a laser beam. The mathematical model involves the hydrodynamic description of the plasma and the MHD equations deduced from this description (BBKGY system).
NSA

N72-22724# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France).
STABILIZATION OF AN UNSTABLE MODE BY NONLINEAR COUPLING TO DAMPED WAVES
A. Berthomieux, G. Laval, and R. Pellat 1971 12 p refs Presented at Conf. on Plasma Theory, Kiev, 19-23 Oct. 1971
(CEA-CONF-1848; Conf-711016-3) Avail: AEC Depository Libraries

The stabilization of an unstable mode by nonlinear coupling with two damped modes is discussed. It is known that such stabilization is possible using the random phase approximation to compute the resonant mode-mode coupling interaction; in this case a stable equilibrium state is found for the amplitudes. The coherent interacting wave model is, however, better suited to describe the case of an unstable wave excited with a narrow beam of particles, in which finite dimensions play a significant role. The stabilization of a coherent unstable wave by resonant mode-mode coupling with two damped coherent waves is then considered. A quasi-stationary equilibrium always exists but the stability conditions associated with this type of equilibrium are very restrictive. NSA

N72-22725# Oak Ridge National Lab., Tenn.
MICROWAVE HEATED PLASMA (ELMO) AS A SOURCE OF MULTIPLY CHARGED IONS
A. VanderWoude 1972 28 p refs Presented at Intern. Conf. on Multiply-Charged Ions and Accelerating Sys., Gatlinburg, Tenn., 25-28 Oct. 1971 Sponsored by AEC
(Conf-711021-7) Avail: NTIS

The ELMO device in which a large volume of high-energetic, high-density plasma is created by microwave heating in a magnetic mirror is briefly described. The conditions in ELMO are such that single impact is the dominant process at least for the higher charge states. Relevant single-impact cross sections are reviewed. Some experimental results for multiply charged heavy ions are discussed. NSA

N72-22726# Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics and Fusion Research.
THE PARTIALLY IONIZED PLASMA CENTRIFUGE
B. Lehnert 2 Jan. 1971 19 p refs
(TRITA-EPP-72-01) Avail: NTIS

The partially ionized plasma centrifuge contains a neutral gas mixture of isotopes or elements, the motion of which is driven by a small amount of rotating plasma. The plasma motion is, in its turn, controlled by externally imposed electric and magnetic fields. Earlier investigations of the centrifuge are extended by an analysis of its operation conditions. It is shown that high rotational velocities, large separation degrees, and stable velocity profiles can be achieved at comparatively small power losses, within certain ranges of the parameters involved.
Author (ESRO)

N72-22727# Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics and Fusion Research.
SOME TECHNOLOGICAL PROBLEMS OF THE COIL SYSTEM OF INTERNAL RING DEVICES
B. Lehnert 16 Jul. 1970 30 p refs
(TRITA-EPP-71-15) Avail: NTIS

Technological problems of the coil system of internal ring devices with magnetically shielded supports are discussed under thermonuclear reactor conditions: (1) The ohmic power losses of the internal ring system can be made much smaller than the thermonuclear reaction power, even with copper windings at room temperature. This is not only the case for the DT reaction, but it even becomes possible for the DD reaction at powers of about 10 to the 10th power W and radial dimensions of the

order of 10 m. The physical reason for this result is that only a fraction of the total field energy of the system originates from the internal coil under optimum conditions. (2) The supports can be made large enough to provide cooling ducts for the internal ring system. (3) The mechanical stresses on the system can be kept within technically feasible limits. Author (ESRO)

N72-22728# European Space Research Inst., Frascati (Italy).
NONLINEAR THEORY OF CROSS-FIELD INSTABILITY WITH APPLICATION TO THE EQUATORIAL ELECTROJET
Andre Rogister Feb. 1972 17 p refs Revised Submitted for publication
(ESRIN-IN-164-Rev) Avail: NTIS

A nonlinear theory of the cross-field instability is presented in which the energy is transferred by mode coupling from large to small wavelengths where it is absorbed by linear damping (classical diffusion). The parameters are chosen to fit the conditions in the equatorial electrojet when the instability is most easily observed. Author (ESRO)

N72-22729# Aerospace Corp., El Segundo, Calif. Plasma Research Lab.
EVIDENCE FOR DEPARTURES FROM EQUILIBRIUM IN AN RF INDUCTION PLASMA IN ATMOSPHERIC-PRESSURE ARGON Report for Sep. 1969 - Dec. 1970
Stanley L. Leonard 1 Aug. 1971 25 p refs
(Contract F04701-71-C-0172)
(AD-735303; SAMSO-TR-71-312; TR-0172(2220-01)-2) Avail: NTIS CSCL 20/9

Spectroscopic observations are reported of an atmospheric-pressure argon plasma generated inductively by a high-power rf oscillator. Values of the excitation temperature T sub ex, obtained from measurement of the relative intensities of spectral lines, were substantially greater than temperature values T sub eq, determined from absolute continuum and line intensities on the assumption of local thermodynamic equilibrium. If a collisional-radiative plasma model is used, the absolute intensity measurements yield temperatures T sub cr, which are in better agreement with the T sub ex values. Author (GRA)

N72-22730# Aerospace Corp., El Segundo, Calif. Plasma Research Lab.
A DUAL MAGNETIC PROBE SYSTEM FOR PHASE MEASUREMENTS IN THERMAL INDUCTION PLASMAS Report for Jun. 1970 - Apr. 1971
Hans U. Eckert 30 Nov. 1971 38 p refs
(Contract F04701-71-C-0172)
(AD-735307; TR-0172(2220-01)-1; SAMSO-TR-71-317) Avail: NTIS CSCL 20/9

Previously reported measurements of rf magnetic field distributions in thermal induction plasmas by a watercooled coil probe have been extended to phase measurements through the use of a second identical probe placed at a fixed position near the plasma boundary. From measurements of the vector sum and/or difference in addition to the individual signals from both probes, data for the variation of the phase angle with radius were obtained. The reliability of the method was checked with an electrolyte of known conductivity. Tests conducted at 2.6 MHz in a 14 cm wide argon plasma column at ambient pressure yielded a change in phase angle of 285 degrees over the radius. The variations in phase and magnitude of the magnetic field were used to derive those of the induced electric field, the current density, the electrical conductivity, and the real part of the Poynting vector. From the latter a specific power input of about 1500 W/cm was obtained. Author (GRA)

N72-22731# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CONCERNING THE SOLUTION OF LINEARIZED EQUATIONS OF MAGNETOHYDRODYNAMICS WITH THE HELP OF FOURIER TRANSFORMS
Margareta Ignat 15 Nov. 1971 9 p refs Transl. into ENGLISH from Jassy Univ. Analele Stiintifice (Rumania), v. 16, no. 16, 1970 p 7-12
(AF Proj. 7073)
(AD-736491; FTD-HC-23-1083-71) Avail: NTIS CSCL 20/9

The generalized method of Lighthill, based on multidimensional Fourier transforms, is used to study a compressible plasma with dissipative effects. This method can be used for studying magnetohydrodynamic waves in different configurations. Author (GRA)

N72-22732# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
AN EXPERIMENTAL DETERMINATION OF THE POLARIZABILITY FOR SINGLY IONIZED ARGON
M. P. F. Briston Apr. 1971 93 p refs
(Grant AF-AFOSR-1368-68A)
(AD-736015; UTIAS-158; AFOSR-71-2461TR) Avail: NTIS CSCL 20/9

Two-wavelength interferometry, employing either a ruby (6943A) or a neodymium (10,600A) laser with a second harmonic generator, was used to study argon plasmas in a shock tube for shock Mach numbers from 17 to 24, initial pressures from 3.0 to 0.3 mm Hg and for degrees of ionization up to 50%. The measured equilibrium electron densities for both wavelength pairs were about 1.9% greater than the calculated values accounting for the excited states, but 1.6% less than the values based on the neglect of these states. Assuming a plasma of free electrons and ground-state atoms and ions, the interferograms yielded ratios of the polarizability for the argon ion to that for the atom. These results are in general agreement with the value of 0.716 for the ratio of the static polarizabilities obtained by the method of Slater screening constants. Author (GRA)

N72-22733# California Univ., Los Angeles. Plasma Physics Group.
COMPUTATIONAL AND EXPERIMENTAL PLASMA PHYSICS FOR THEORETICIANS
Burton D. Fried Jan. 1972 33 p refs
(Contract N00014-69-A-0200-4023)
(AD-736615; PPG-107) Avail: NTIS CSCL 20/9

The report discusses how a theoretician can actively participate in both computational and experimental plasma physics, avoiding both the tiresome book-keeping associated with conventional programming and the technical complexities of hardware. The author describes the currently operating, on-line mathematical facilities, discusses the experimental devices, and shows some illustrative problems. Author (GRA)

N72-22734# Avco-Everett Research Lab., Everett, Mass.
DISSOCIATIVE RECOMBINATION RATE MEASUREMENTS IN N2, CO AND He
D. H. Douglas-Hamilton Nov. 1971 27 p refs
(Contract F44620-70-C-0023; AF Proj. 9752)
(AD-736042; AERL-RR-343; AFOSR-72-0231TR) Avail: NTIS CSCL 20/9

A method of generating an atmospheric pressure, high electron density plasma with arbitrary electron temperature is described, and applied to measurement of electron ion recombination rates in N2 and CO. Preliminary results for He are also given. The recombination rates are shown to be independent of pressure in the region functions of E/N. Author (GRA)

N72-22735# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
EFFECT OF COLLISIONS ON ELECTROSTATIC PROBE MEASUREMENTS
J. Bornstein and S. Lederman Nov. 1971 25 p refs
(Contract DAHC04-69-C-0077; ARPA Order 1442)
(AD-736387; PIBAL-71-32) Avail: NTIS CSCL 20/9

An experimental investigation of the length effects as a function of collisions in the sheath of a slightly ionized hypersonic flow regime for cylindrical ion collecting probes is

undertaken. The results indicate a strong dependence of the length effect on the number of collisions in the sheath and also on the degree of ionization of the media. Author (GRA)

N72-22736# Minnesota Univ., Minneapolis. Dept. of Electrical Engineering.
STUDY OF PLASMA SHEATHS *Final Report, 1 Feb. 1968 - 1 Jul. 1971*
Hendrick J. Oskam and James L. Peng Aug. 1971 87 p refs
(Contract F19628-68-C-0245; AF Proj. 8659)
(AD-736462; AFCRL-71-0425) Avail: NTIS CSCL 10/2

Results obtained from a study of current-voltage characteristics of gas diodes with and without positive ion injection are reported. It was found that ions are very effective in neutralizing the negative space-charge barrier in front of the thermionic emitter. Pulsed ion injection studies showed that the rate of loss of positive ions from the barrier region decreases with increasing barrier height and decreasing diffusion coefficient of the injected ions. These results were consistent with those obtained during the steady state studies. A theoretical model of a gas diode with and without ion injection was constructed. This model was numerically solved for a gas diode without ion injection for various experimental conditions. The results obtained indicate the desirability to extend the calculations to a gas diode with ion injection in order to explain the observed large space-charge neutralization efficiencies of the injected ions. Author (GRA)

N72-22737# Naval Research Lab., Washington, D.C.
HIGH MACH NUMBER TURBULENT MAGNETOSONIC SHOCKS
K. Papadopoulos, C. E. Wagner, and I. Haber Nov. 1971 18 p refs
(NRL Proj. 77H02-27)
(AD-736179; NRL-MR-2359) Avail: NTIS CSCL 20/9

High M sub A turbulent magnetosonic shocks have been simulated using an electromagnetic particle code, by driving a purely reflecting piston into the plasma. A physical analysis of the results is presented together with scaling arguments and comparisons with experimental data. Author (GRA)

N72-22381*# Rice Univ., Houston, Tex. Dept. of Space Science.
MAGNETOSPHERIC PLASMA PHENOMENA AT THE GEOSTATIONARY ORBIT
J. W. Freeman, Jr. and D. T. Young *In* ESRO The ESRO Geostationary Magnetospheric Satellite Mar. 1971 p 69-78 refs (See N72-22377 13-13)
(Contracts NSR-44-006-100; NAS5-9561)
(NASA-CR-126237) Avail: NTIS CSCL 03B

N72-22394# Technical Univ. of Denmark, Lyngby. Ionosphere Lab.
CHARGED PARTICLE EMISSION FROM A GEOSTATIONARY SATELLITE
Peter Stauning *In* ESRO The ESRO Geostationary Magnetospheric Satellite Mar. 1971 p 183-199 refs (See N72-22377 13-13)
Avail: NTIS

N72-22396# Sussex Univ., Brighton (England). Plasma Physics Group.
PRELIMINARY PROPOSAL FOR EXPERIMENTS ON THE ESRO GEOSTATIONARY SATELLITE (GEOS)
G. Martelli and J. Troughton *In* ESRO The ESRO Geostationary Magnetospheric Satellite Mar. 1971 p 213-222 refs (See N72-22377 13-13)
Avail: NTIS

N72-22400# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
PROBLEMS OF DC ELECTRIC FIELD MEASUREMENTS FROM A GEOSTATIONARY SATELLITE
U. Fahleson *In* ESRO The ESRO Geostationary Magnetospheric Satellite Mar. 1971 p 249-265 refs (See N72-22377 13-13)
Avail: NTIS

N72-22401# Groupe de Recherches Ionospheriques, Paris (France).
ELECTRIC FIELD EXPERIMENTS: ALTERNATING FIELDS
L. R. O. Story *In* ESRO The ESRO Geostationary Magnetospheric Satellite Mar. 1971 p 267-279 refs (See N72-22377 13-13)
Avail: NTIS

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N72-22738*# Little (Arthur D.), Inc., Cambridge, Mass.
DEVELOPMENT OF A THEORY OF THE SPECTRAL REFLECTANCE OF MINERALS, PART 3 **Interim Technical Summary Report**
J. R. Aronson, A. G. Emslie, L. H. Roach, E. M. Smith, and P. C. VonThuena 1 Jan. 1972 64 p refs
(Contract NAS9-10875)
(NASA-CR-115521; ADL-C-72594-Pt-3) Avail: NTIS CSCL 20L

Significant refinements were made in the theory of the diffuse reflectance of particulate media. The theory predicts the opposite trends of reflectance with particle size in regions of the spectrum in which the particles are semi-transparent and those in which they are opaque. Enhanced absorption caused by wave-optical effects of small surface asperities and edges was used to improve the theory. The same mechanism remedies the theory to account for the data in spectral regions of anomalous dispersion. Author

N72-22739*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SATURATION MAGNETIZATION OF POLYCRYSTALLINE IRON
Donald R. Behrendt and Donald E. Hegland Washington Apr. 1972 7 p refs
(NASA-TM-X-2542; E-6769) Avail: NTIS CSCL 20L

The magnetic moment per gram, sigma (H sub I, T), where H sub I is the internal field and T is the temperature, was measured for a polycrystalline iron sphere with the vibrating-sample magnetometer. The instrument was calibrated by using a method utilizing the high permeability of an iron sphere. The spontaneous moment, sigma(0, T),was obtained from plots of sigma(H sub I, T) as a function of H sub I for temperatures from 4.2 K to room temperature. The value of the spontaneous moment, sigma(0, T), at 298.9 K was 217.5 + or -0.4 emu/g. The extrapolated moment, sigma(0, 0),at absolute zero from a plot of sigma(0, T) as a function of T to 3/2 power was 221.7 + or - 0.4 emu/g. Author

N72-22740# Joint Publications Research Service, Arlington, Va.
METHODS OF INVESTIGATING THE THERMOELECTRIC PROPERTIES OF SEMICONDUCTORS
V. M. Glazov, A. S. Okhotin, R. P. Borovikova, and A. S. Pushkarskiy 30 Mar. 1972 38 p Transl. into ENGLISH from the book "Metody Issledovaniya Termoelektricheskikh Svoystv Poluprovodnikov" Moscow, Atomizdat Press, 1969 p 2, 131-167
(JPRS-55583) Avail: NTIS

The investigation of the thermoelectric properties of

semiconductors at various temperatures in connection with the direct conversion of thermal energy into electric power is discussed. The physical essence of thermoelectric phenomena and properties of semiconductors and the theoretical principles of the methods of measuring thermal emf's electrical conductivity, thermal conductivity and the Hall effect are described. Descriptions of the equipment and a comparative analysis of the various procedures are presented for each method. The method of measuring the thermoelectric properties of liquid semiconductors are discussed in detail. Author

N72-22741*# GTE Labs., Inc., Bayside, N.Y. Research Center.
EPITAXIAL GALLIUM ARSENIDE WAFERS Final Report, 18 Nov. 1970 - 18 Nov. 1971
J. F. Black and L. B. Robinson 3 Dec. 1971 35 p refs
(Contract NAS5-21583)
(NASA-CR-122391; TR-71-839.12) Avail: NTIS CSCL 20L

The preparation of GaAs epitaxial layers by a vapor transport process using AsCl3, Ga and H2 was pursued to provide epitaxial wafers suitable for the fabrication of transferred electron oscillators and amplifiers operating in the subcritical region. Both n-n(+) structures, and n(++)-n-n(+) sandwich structures were grown using n(+) (Si-doped) GaAs substrates. Process variables such as the input AsCl3 concentration, gallium temperature, and substrate temperature and temperature gradient and their effects on properties are presented and discussed. Author

N72-22742# Sandia Labs., Albuquerque, N.Mex.
RADIATION EFFECTS CHARACTERISTICS OF CURRENT MOS DEVICES
Floyd N. Coppage Nov. 1971 22 p refs Sponsored by AEC
(SC-RR-710821) Avail: NTIS

To determine if it is possible to obtain MOS devices which are tolerant to ionizing radiation, devices fabricated by several manufacturers were evaluated in both gamma rays and, in some instances, neutrons. This evaluation covered devices utilizing several different fabrication techniques, some of which were aimed at increasing the radiation tolerance. These data show that MOS devices which are very tolerant to radiation are possible and commercially available. Author (NSA)

N72-22743# Eidgenossische Technische Hochschule, Zurich (Switzerland).
ISOTOPE EFFECT OF THE SUPERCONDUCTORS CADMIUM, MOLYBDENUM, AND ZIRCONIUM, 1. THE PRESSURE EFFECT OF SEVERAL SUPERCONDUCTING ELEMENTS, 2 Ph.D. Thesis [DER ISOTOPIEEFFEKT DER SUPRALEITER CADMIUM, MOLYBDAEN UND ZIRKON, 1. ZUM DRUCKEFFEKT EINIGER SUPRALEITENDER ELEMENTE, 2]
Claudio Palmy 1970 70 p refs In GERMAN; ENGLISH summary
(NP-19140; Diss-4546) Avail: AEC Depository Libraries

Investigations on the isotope effect of the superconductors Zr, Mo, and Cd are reported. The experimental results show a vanishing isotope effect in Zr and an intermediate one in Cd and Mo. These deviations from the normal isotope effect are well understood within the framework of the BCS theory if the Coulomb repulsion is included in the effective interaction. Author (NSA)

N72-22744# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Experimentelle Kernphysik.
MEASUREMENT OF THE THERMAL CONDUCTIVITY OF SUPERCONDUCTING COIL WINDINGS BETWEEN 4 K AND 10 K [MESSUNG DER THERMISCHEN LEITFAEHIGKEIT SUPRALEITENDER SPULENWICKLUNGEN ZWISCHEN 4 K UND 10 K]
G. Krafft Jun. 1971 24 p refs In GERMAN
(KFK-1347) Avail: AEC Depository Libraries

Thermal conductivity measurements of different superconducting coil windings and epoxy resins between 4 and 10K are described. By admixture of Al2O3 or Cu powder, the thermal conductivity of epoxy resin could be improved by a factor of five from 3.5 x .0001 to 1.5 x 10 .001 W/cm . K. With regard to coils fabricated of wires with pure Cu matrix, coils made of superconducting multicore wire with a CuNi matrix potted with epoxy resin had the worst conductivity (approximately 9 x .0001 W/cm times K) at 4.2K. Author (NSA)

N72-22745# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Experimentelle Kernphysik.
THE ac LOSSES IN SUPERCONDUCTING SYNCHROTRON MAGNETS
H. Brechna and G. Ries Apr. 1971 11 p refs Presented at Natl. Particle Accelerator Conf., Chicago, Ill., 1-3 Mar. 1971
(KFK-1371; Conf-710308-31) Avail: AEC Depository Libraries

Alternating current losses of composite conductors and synchrotron magnets are given. A new equation, based on a skin-effect assumption, is presented which shows that the generally accepted self-field calculations yield too high values. Results from loss equations are compared to a few tests on small solenoids. Losses in superconducting coils when exposed to time varying magnetic fields have several origins. Eddy current losses in the conductor matrix, self-field, hysteretic and auxiliary losses in the superconducting coils and composite conductors, hysteretic and eddy current losses in the iron return path and eddy current losses in the metallic support structure, reinforcements and containers. As all losses including heat conduction and radiation have to be removed by the coolant, the major effort will be to limit these losses to manageable low values. The results of new investigations are summarized. Author (NSA)

N72-22746# Institute of Nuclear Research, Krakow (Poland).
MOESSBAUER EFFECT ANALYSIS OF Fe-Mn MODULES FROM VARIOUS PACIFIC OCEAN LOCATIONS
A. Z. Hrynkiewicz, A. J. Pustowka, B. D. Sawicka, and J. A. Sawicki May 1971 14 p refs
(INP-767) Avail: AEC Depository Libraries

The possible use of Mossbauer spectroscopy to study iron-manganese concentrations from Pacific Ocean locations is demonstrated. All the data presented confirm in general that the chemical state of the iron in nodules is practically the same as in Fe(OH)3 gels and does not depend on the geographical location, time or conditions of storage of the samples nor on the part of the nodule. It was suggested that the small discrepancies in the magnitudes of quadrupole splittings might be explained by size-dependent electric field gradients in ultra-fine particles. The results of the measurements for samples taken from different places along the diameter of one nodule indicate a greater abundance of iron and smaller size of particles in the outer shells of the nodule than in the central part. The results might be useful in the study of the origin of the nodules and the conditions of their formation. Author

N72-22747# Brookhaven National Lab., Upton, N.Y.
SOME PROPERTIES OF TRANSITION METAL SUPERCONDUCTORS AT SURFACES AND IN THIN FILMS
Myron Strongin 1971 14 p refs Presented at 17th Ann. Conf. on Magnetism and Magnetic Mater., Chicago, Ill., 16 Nov. 1971 Sponsored by AEC
(BNL-16267; Conf-711108-9) Avail: NTIS

Low energy electron diffraction (LEED) and Auger spectroscopy measurements on Nb surfaces are described and the results are related to some of the problems encountered in the design of superconducting RF cavities. Possible protective coverings for the Nb surfaces that are used in these cavities are discussed, and experiments on one type of covering, i.e., thin layers of Nb3Sn grown on Nb, are described. Finally, experiments on amorphous transition metal films are presented and the results of the measurements are discussed in the context of LEED measurements of theta sub D at the niobium surface. Author (NSA)

N72-22748# Georgetown Univ., Washington, D.C.
SUPERCONDUCTIVE ENERGY GAP GALLIUM AS A FUNCTION OF CRYSTAL ORIENTATION Ph.D. Thesis
Leon Stephan Straus Jul. 1971 183 p refs
(Contract AT(40-1)-3665)
(TID-25866) Avail: NTIS

The energy gap versus crystal orientation in the gallium AB plane was obtained from many single crystal high impedance Ga(x)O(y) Pb tunnel junctions. The I-V characteristics can be correlated with the local anisotropy of the energy gap and the Fermi surface characteristics. In certain crystal directions (32, 36, 61.5, and 70 degrees in the AB plane and along the c axis), multiple energy gaps were observed. These multiple energy gaps appear to correspond to simultaneous tunneling into two different gallium Fermi surfaces. The anisotropy of the gallium energy gap was observed to be about 5% in this plane, a value that is low when compared to other estimates of the anisotropy taken on the bulk of the material. These data, along with the data of Yoshihiro and Sasaki, were used to examine the tunneling selection rules for gallium in light of the discussions of Dowman, MacVicar, and Waldram. The best fit of the data to the Fermi surface characteristics is obtained when tunneling is assumed to occur in a direction normal to the crystal surface. Author (NSA)

N72-22749# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ADVANCED ELECTRONIC TECHNOLOGY Quarterly Technical Summary, 1 Aug. - 31 Oct. 1971
Melvin A. Herlin and Alan L. McWhorter 15 Nov. 1971 25 p ref
(Contract F19628-70-C-0230; AF Proj. 649L)
(AD-735325; ESD-TR-71-298) Avail: NTIS CSCL 20/12

Contents: Integrated circuit design and fabrication; Integrated circuit applications; Semiconductor testing; Machine development; Solid state device research; Quantum electronics; Materials research; Physics of solids; Microelectronics. GRA

N72-22750# Cornell Univ., Ithaca, N.Y.
HARMONIC CAPABILITIES OF THE LIMITED SPACE-CHARGE ACCUMULATION MODE IN GALLIUM ARSENIDE
Daniel John Szostak Griffiss AFB, N. Y. RADC Dec. 1971 73 p refs
(Contract F30602-71-C-0110)
(AD-735753; RADC-TR-71-296) Avail: NTIS CSCL 20/12

The major objective of this contract is to study active microwave bulk and transit time phenomena in solid-state materials. This report specifically represents a final report on the study of effective signal generation at selected lower harmonics of a limited spacecharge accumulation (LSA) mode oscillator. The key parameters of the LSA diode, its circuit and operating conditions for the most efficient signal generation at any selected harmonic frequency were investigated experimentally and analytically. Fundamental frequency efficiency as high as 17%, second harmonic efficiency as high as 8.5%, third harmonic efficiency of 2.8% and fourth harmonic efficiency of 1.8% were all separately obtained experimentally using a multi-axis radial cavity. Author (GRA)

N72-22751# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Physics.
THE ELECTROMAGNETIC PROPERTIES OF CONDENSED MATTER Final Report
B. S. Chandrasekhar, T. G. Eck, D. E. Farrel, W. L. Gordon, and J. F. Reichert Dec. 1971 9 p refs
(Contract F44620-69-C-0077; AF Proj. 9764)
(AD-735786; AFOSR-72-0124TR) Avail: NTIS CSCL 20/12

The effect of impurities on thermal and electromagnetic properties of superconductors, phonon spectra, electron-phonon interactions, Fermi surfaces and electron energy bands, electron relaxation times and spin interactions were studied in normal and superconducting metals. The report very briefly lists the results from the research. Among the techniques used were electron tunneling, quantum oscillatory phenomena, spin and cyclotron resonance, galvanomagnetic and thermomagnetic methods. Impurity states in insulators were explored by ENDOR techniques. Author (GRA)

N72-22752# Aerospace Corp., El Segundo, Calif. Electronics Research Lab.
SELF-PUMPED JOSEPHSON PARAMETRIC AMPLIFICATION Report for Jan. - Jun. 1971
Helmut Kanter and Arnold H. Silver 15 Nov. 1971 18 p refs
(Contract F04701-71-C-0172)
(AD-735302; TR-0172(9230-20)-7; SAMSO-TR-71-292) Avail: NTIS CSCL 20/12

Parametric gain has been demonstrated at 30 MHz using the non-linear inductance of Josephson point contact devices. SQUID type configurations were used to achieve degenerate mode, negative resistance amplification with self-pumping achieved via the internal Josephson oscillations. Gain as large as 11 dB was measured. The small signal analysis predicts parametric amplification and delineates the importance of the critical current, circuit loss, and circuit coupling efficiency. Author (GRA)

N72-22753# Maryland Univ., College Park.
OPTICAL AND ELECTRICAL PROPERTIES OF AMORPHOUS ELEMENTAL SEMICONDUCTORS
Rolfe E. Glover, III and Robert Glosser 31 Dec. 1971 5 p ref
(Grant DA-ARO(D)-31-124-71-G134; ARPA Order 1562)
(AD-736508; AROD-9290-1-P) Avail: NTIS CSCL 20/12

The cryostat for in situ investigation of the optical and electrical properties of amorphous materials has been built and preliminary tests are now being made. This coupled with an ion pump vacuum system is expected to provide much needed information on the intrinsic nature of amorphous materials evaporated under controlled conditions. An optical system for measuring the incident, transmitted, and reflected beam is also completed and tested. Work on the optical and electrical properties of amorphous silicon have been continued with improved precision. Author (GRA)

N72-22754# Army Electronics Command, Fort Monmouth, N.J.
SEMICONDUCTOR CONDUCTIVITY USING A HIGH SENSITIVITY TECHNIQUE M.S. Thesis - Monmouth Coll., West Long Beach, N. J.
Samuel Dixon, Jr., Robert F. Diordano, and Harold Jacobs Nov. 1971 60 p refs
(Contract DA Proj. 1S6-62705-A-055)
(AD-736366; ECOM-3507) Avail: NTIS CSCL 20/12

An experimental study of a reflection cavity scheme used to measure changes in the conductivity of semiconductor samples is presented. The germanium sample with associated microwave circuitry acts as a highly sensitive system whereby in the null condition almost complete absorption occurs. Changes in conductivity from the null point will cause a sharp increase in reflected microwave power. This change in reflected power may be used to measure a change in conductivity, or in a device application would represent the output signal. Calculations indicate that as an infrared photo-conductive detector, this microwave effect may be competitive with state-of-the-art components. Author (GRA)

N72-22755# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOLID STATE RESEARCH, 1971:4 Quarterly Technical Summary, 1 Aug. - 31 Oct. 1971
Alan L. McWhorter 26 Jan. 1972 82 p refs
(Contract F19628-70-C-0230; AF Proj. 649L)
(AD-736501; ESD-TR-71-300) Avail: NTIS CSCL 20/12

The report covers in detail the solid state research work of the Solid State Division at Lincoln Laboratory for the period 1 August through 31 October 1971. The topics covered are Solid State Device Research, Quantum Electronics, Materials Research, Physics of Solids and Microelectronics. The Microsound work is sponsored by ABMDA and is reported under that program. Author (GRA)

N72-22756# Hebrew Univ., Jerusalem (Israel).
STUDIES OF HOLE-TRAP DISTRIBUTIONS AND VALENCE-BAND STUCTURE IN ANTHRACENE Final Technical Report, Jul. 1970 - Jun. 1971
A. Many and Z. Burshtein Aug. 1971 27 p refs
(Contract DAJA37-71-C-0456; DA Proj. 200-61102-B-31E)
(AD-736394; ARDG(E)-E-1437) Avail: NTIS CSCL 20/12

Measurements are reported of the spectral yield and other characteristics of the photocurrent arising from optical excitation of holes from bulk traps into the valence band of anthracene.
GRA

N72-22757# Gulf Radiation Technology, San Diego, Calif.
ELECTRICAL AND OPTICAL PROPERTIES OF III-V SEMICONDUCTORS Final Report, 1 Aug. 1970 - 15 Aug. 1971
Arne H. Kalma, Robert A. Berger, Roland E. Leadon, and James A. Naber 2 Sep. 1971 92 p refs
(Contract F19628-70-C-0311; AF Proj. 4608; AF Proj. 5620)
(AD-736418; GULF-RT-A10824; AFCRL-71-0494) Avail: NTIS CSCL 20/12

The electrical and optical properties of both n-and p-type GaAs irradiated at room temperature with 1-MeV electrons were measured and correlated. Post-irradiation annealing up to 500C was investigated.
Author (GRA)

N72-22758# Paris Univ. (France). Lab. de Physique des Solides.
BAND STRUCTURE AND DISPERSION RELATIONS IN 2-6 COMPOUNDS AND THEIR ALLOYS Final Scientific Report, 1 Oct. 1967 - 31 Mar. 1971
M. Balkanski 31 Mar. 1971 7 p
(Grant EOOAR0016-68; AF Proj. 7885)
(AD-736033; ARL-71-0301) Avail: NTIS CSCL 20/12

The work deals with the phonon dispersion relations and band structures of II - VI compounds. Among the materials investigated are CdS, ZnS, Mn doped ZnS, CdSe, CdTe, ZnTe, ZnSe, HgTe. Experimental studies included Raman scattering, infrared spectra and associated techniques. Theoretical investigations were also undertaken.
Author (GRA)

N72-22759# Pennsylvania State Univ., University Park. Dept. of Physics.
THEORETICAL INVESTIGATION OF SURFACE AND BULK ELECTRONIC AND ATOMIC PROPERTIES OF METALS Final Scientific Report
Paul H. Cutler Dec. 1971 18 p refs
(Grant AF-AFOSR-1704-69)
(AD-736048; AFOSR-71-3133TR) Avail: NTIS CSCL 20/12

The objectives of the research program was to understand in terms of electronic and atomic theories, and model calculations, certain features of the surface and volume properties of metals. Of several surface studies, one provided for the first time quantitative evidence for the importance of surface roughness for a significant surface photoemission. Other studies correlated energy band structure with electron energy distributions and spin polarization from ordinary and ferromagnetic transition metals. A first principles calculation with modified one electron theory described the optical absorption in sodium. Extensive calculations demonstrated that one can obtain consistent and excellent agreement of atomic and electronic experimental properties with those obtained from a first principles non-local pseudopotential.
Author (GRA)

N72-22760# Emmanuel Coll., Boston, Mass. Oriental Science Research Library.
THERMAL STABILITY OF WURTZITE AND SPHALERITE STRUCTURES
Yoshito Inomata 4 Oct. 1971 19 p refs Transl. into ENGLISH from Yogyo Kyokai Shi (Tokyo), v. 78, no. 11, 1970 p 365-369
(AD-736407; Emm-71-266; Rept-71-2; AFCRL-71-0513; AFCRL-Trans-94) Avail: NTIS CSCL 20/2

The thermal stability of the tetrahedral wurtzite and sphalerite structures is discussed using AlN, BeO, ZnS, and SiC structural and physical data.
Author (GRA)

N72-22761# Air Force Cambridge Research Labs., L. G. Hanson Field, Mass. Microwave Physics Lab.
MEASUREMENT OF THE ELASTIC, PIEZOELECTRIC, AND DIELECTRIC CONSTANTS OF Bi12GeO20 Interim Report
A. J. Slobodnik, Jr. and J. C. Sethares 10 Nov. 1971 31 p refs
(AF Proj. 5635)
(AD-736797; AFCRL-71-0570; PSRP-467) Avail: NTIS CSCL 20/12

The low acoustic velocity of bismuth germanium oxide (B12 Ge O20) has made it an attractive delay line material for achieving long time delays in short spaces. To resolve conflicting published results concerning the values of the elastic, piezoelectric, and dielectric constants of Bi12 Ge O20, an exhaustive study of the material was made. Over 45 samples of material grown by 3 independent sources were tested. The basic technique adopted for determining the elastic and piezoelectric coefficients involved the frequency measurement of acoustic resonances of thin plates. Since the largest discrepancy between two previous series of measurements was in the value of the piezoelectric constant, this coefficient was determined using three different methods. The first accurate determination of the dielectric constant of Bi12 Ge O20 at microwave (2 to 4 GHz) frequencies was made by measuring the frequency of a low order TE electromagnetic mode of a disk resonator placed between two semi-infinite conducting planes. A listing of the computer program relating theory and experiment for this measurement is provided.
Author (GRA)

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N72-22762*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SLUSH HYDROGEN LIQUID LEVEL SYSTEM
J. F. Hamlet and R. G. Adams 27 Jan. 1972 25 p
(NASA-TM-X-64643) Avail: NTIS CSCL 21I

A discrete capacitance liquid level system developed is specifically for slush hydrogen, but applicable to LOX, LN2, LH2, and RP1 without modification is described. The signal processing portion of the system is compatible with conventional liquid level sensors. Compatibility with slush hydrogen was achieved by designing the sensor with adequate spacing, while retaining the electrical characteristics of conventional sensors. Tests indicate excellent stability of the system over a temperature range of -20 C to 70 C for the circuit and to cryogenic temperatures of the sensor. The sensor was tested up to 40 g's rms random vibration with no damage to the sensor. Operation with 305 m of cable between the sensor and signal processor was demonstrated. It is concluded that this design is more than adequate for most flight and ground applications.
Author

N72-22763# Institut Franco-Allemand de Recherches, St. Louis (France).
ENERGY TRANSFER IN EXPLOSIVE PROPULSION
M. Defourneaux 6 Jul. 1970 96 p refs In FRENCH; ENGLISH summary
(ISL-14/70) Avail: NTIS

Approximate analytical formulas have been developed for the computation of projectile velocity and the ratio between projectile mass and the mass of the explosive charge. Good

agreement with strict computer calculations has been found in the practical range of values of this ratio. Momentum (I) and kinetic energy (E) of the driven mass are discussed, both I and E corresponding either to a unit of mass of explosive or to the total mass. Specific impulse, considered as being the limit of I when the ratio between projectile mass and the mass of the explosive charge tends to infinite, is discussed. ESRO

N72-22764# Aerojet Liquid Rocket Co., Sacramento, Calif.
PROPELLANT/MATERIAL COMPATIBILITY STUDY Final Report, 1 Sep. 1970 - 15 Sep. 1971
E. M. VanderWall, R. L. Suder, R. L. Beggle, Jr., and J. A. Cabeal Edwards AFB, Calif. AFRPL Dec. 1971 62 p refs
(Contract F04611-71-C-0004; AF Proj. 3148)
(AD-736464; AFRPL-TR-71-41) Avail: NTIS CSCL 21/9

The objective of this program was to define the threshold sensitivity limit of hydrazine fuels in common metallic materials of construction as a function of temperature and pressure. Four propellants were included in the program: hydrazine, monomethylhydrazine, MHF-5, and MHF-7. Eleven metallic materials of construction were included in the program: stainless steel 304L, 316, 321, 347, and 17-7PH; aluminum 1100-0, 6061-T6, and 2014-T6; Inconel-X 750; Haynes-25; and Hastelloy-X. Three standard tests were used to determine the threshold sensitivity limit of the propellants in the various materials: thermal stability test, detonation propagation test, and U-tube adiabatic compression test. Author (GRA)

N72-22765# ARO, Inc., Arnold Air Force Station, Tenn.
AN ANALYTICAL INVESTIGATION OF THE CASELESS ROCKET MOTOR Final Report, Jun. 1970 - Jun. 1971
C. E. Willbanks, R. C. Bauer, and P. T. Harsha AEDC Feb. 1972 46 p refs
(Contract F40600-72-C-0003; AF Proj. 3059; ARO Proj. RW5174)
(AD-736457; AEDC-TR-72-14; ARO-ETF-TR-71-197) Avail: NTIS CSCL 21/9

An analysis of a caseless and nozzleless solid-propellant rocket motor employing the external burning concept was made. Performance was calculated for a wide range of supersonic flight conditions. The results of the analysis show that acceptable values of specific impulse and thrust are possible for propellants having sufficiently high burn rates in a base burning configuration. The effect of boattailing with combustion along the boattail was investigated and found to degrade the performance. An analysis of a thin planar airfoil with external burning occurring on part of its surface was also made. The specific lift, that is the ratio of the lifting force to propellant flow rate, was found to be an order of magnitude lower than the corresponding specific lift for a conventional airfoil propelled by a turbine engine. Author (GRA)

N72-22766# Utah Univ., Salt Lake City. Dept. of Chemical Engineering.
THE RESPONSE OF A BURNING SOLID PROPELLANT SURFACE TO THERMAL RADIATION
C. Max Mihlfeith, Alva D. Baer, and Norman W. Ryan 1 Aug. 1971 159 p refs
(Grant AF-AFOSR-1656-69; AF Proj. 9711)
(AD-736049; AFOSR-71-2664TR) Avail: NTIS CSCL 21/9

A new technique for the study of processes related to propellant combustion instability has been employed in which burning rate variations produced by a periodic radiant heat flux are measured. The phase angle between the perturbing flux and the burning rate response and the dependence of the magnitude of the response on the driving frequency are obtained. As the frequency of the perturbing flux increases, magnitude of the reaction is observed to first increase and then to pass through a maximum. In general, the experimental results tend to confirm the theoretical models for transient burning rate response, although the observed maximums in the response functions appear to occur at higher frequencies than is predicted by the simpler gas-phase models. Author (GRA)

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magneto-hydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N72-22767*+ Aerojet Solid Propulsion Co., Sacramento, Calif.
STUDY OF SOLID ROCKET MOTOR FOR A SPACE SHUTTLE BOOSTER. APPENDIX A: SRM WATER ENTRY LOADS Final Report
15 Mar. 1972 16 p
(Contract NAS8-28428)
(NASA-CR-123612; Rept-1917-FR1-App-A) Avail: NTIS CSCL 21H

An analysis of the water entry loads imposed on the reusable solid propellant rocket engine of the space shuttle following parachute descent is presented. The cases discussed are vertical motion, horizontal motion, and motion after penetration. Mathematical models, diagrams, and charts are included to support the theoretical considerations. Author

N72-22768 Central Electricity Generating Board, London (England).
GAS TURBINES FOR POWER GENERATION, 1962 - NOVEMBER 1971
C. J. Dance, comp. Feb. 1972 24 p refs
(CE-Bib-73) Avail: Issuing Activity

A selected bibliography, containing 108 references, on gas turbines for power generation is presented. An author index and material for United Kingdom and United States installations are included. E.H.W.

N72-22769* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FLUIDIC PROPORTIONAL THRUSTER SYSTEM Patent
Dean M. Chisel, inventor (to NASA) Issued 12 Oct. 1971 9 p Filed 3 Apr. 1969 Supersedes N70-12624 (08 -02, p 0366)
(NASA-Case-ARC-10106-1; US-Patent-3,612,442;
US-Patent-Appl-SN-812998; US-Patent-Class-244-3.22) Avail: US Patent Office CSCL 21H

A proportional thruster system is described, utilizing a fluidic vortex apparatus for controlling the continuous gas flow supplied to a plurality of thrusters. Continuous variable thrust for attitude control applications is provided by the gas flow to a plurality of thruster nozzles through modulated vortex elements. The thruster system is responsive to electronic or fluidic sensed attitude error, sensors, and logic. Official Gazette of the U.S. Patent Office

N72-22770* Hughes Aircraft Co., Culver City, Calif.
ION THRUSTER Patent
Wolfgang Knauer and Robert L. Poeschel, inventors (to NASA) Issued 19 Oct. 1971 4 p Filed 26 Nov. 1969 Supersedes N70-26815 (08 - 13, p 2470) Sponsored by NASA
(NASA-Case-LEW-10770-1; US-Patent-3,613,370;
US-Patent-Appl-SN-880246; US-Patent-Class-60-202) Avail: US Patent Office CSCL 21C

Improving the efficiency of an ion thruster is discussed, utilizing a radial magnetic field to achieve uniformity in electron density and energy. Official Gazette of the U.S. Patent Office

N72-22771* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ION THRUSTER MAGNETIC FIELD CONTROL Patent
Bruce A. Banks, inventor (to NASA) Issued 16 Nov. 1971 4 p Filed 28 Aug. 1970 Supersedes N71-28873 (09 - 16, p 2672)
(NASA-Case-LEW-10835-1; US-Patent-3,620,018;

US-Patent-Appl-SN-67815; US-Patent-Class-60-202) Avail: US Patent Office CSCL 21C

A temperature controlled magnetic shunting system that is self-controlled and operates without power is described for use on an ion thrustor to enable magnetic field sensors to properly sense natural magnetic fields. In the ion thrustor, high ferromagnetic Curie temperature permanant magnets are mounted between the distributor plate and the grid pole. Each permanant magnet is surrounded by Curie temperature alloy, when the thrustor is not operating, the magnetic system is cool, and the low ferromagnetic Curie temperature alloy provides a magnetic shunt, confining the magnetic field to the permanent magnet.
F.O.S.

N72-22772* TRW Systems Group, Redondo Beach, Calif.
SYSTEM FOR PRECONDITIONING A COMBUSTIBLE VAPOR Patent
Charles Mangion, inventor (to NASA) Issued 8 Feb. 1972 7 p Filed 21 Oct. 1970 Sponsored by NASA
(NASA-Case-NPO-12072; US-Patent-3,640,256; US-Patent-Appl-SN-82647; US-Patent-Class-123-122AB; US-Patent-Class-137-81.5; US-Patent-Class-261-145) Avail: US Patent Office CSCL 21A

A system for preconditioning the combustion vapors of fuels before delivery to an internal combustion engine is described. The vapors are heated to a predetermined temperature by hot air from the engine manifold and is delivered to the engine is a continuous flow through the system. It is concluded that preheating the combustible vapors will result in improved combustion.
P.N.F.

N72-22773 National Lending Library for Science and Technology, Boston Spa (England).
THE INFLUENCE OF THE AXIAL GAP AND THE ANGLE OF ATTACK ON THE ALTERNATING AERODYNAMIC FORCES ACTING ON A WORKING BLADE
A. S. Laskin and F. A. Stoyanov Jan. 1972 3 p refs Transl. into ENGLISH from Energomashinostr. (Moscow), v. 4, no. 46, 1968
(NLL-RTS-6962) Avail: Natl. Lending Library, Boston Spa, Engl.: £0.20 or 1 photocopy coupon

An analysis is presented on the influence of the gap between the rotor and stator blades and the angle of attack of the flow on the aerodynamic forces imposed on the rotor blades of a gas turbine engine. The alternating component of the pressure was measured by special strain gage transducers fitted on the blades. Data obtained from the tests are presented in the form of graphs.
Author

N72-22774*# Lockheed Propulsion Co., Redlands, Calif.
STUDY OF SOLID ROCKET MOTORS FOR A SPACE SHUTTLE BOOSTER. VOLUME 1: EXECUTIVE SUMMARY Final Report, 13 Jan. - 15 Mar. 1972
A. H. VonDeresch 15 Mar. 1972 41 p refs
(Contract NAS8-28429)
(NASA-CR-123614; LPC-629-6-Vol-1) Avail: NTIS CSCL 21H

The factors affecting the choice of the 156 inch diameter, parallel burn, solid propellant rocket engine for use with the space shuttle booster are presented. Primary considerations leading to the selection are: (1) low booster vehicle cost, (2) the largest proven transportable system, (3) a demonstrated design, (4) recovery/reuse is feasible, (5) abort can be easily accomplished, and (6) ecological effects are minor.
Author

N72-22775*# Lockheed Propulsion Co., Redlands, Calif.
STUDY OF SOLID ROCKET MOTORS FOR A SPACE SHUTTLE BOOSTER. VOLUME 2, BOOK 1: ANALYSIS AND DESIGN Final Report, 13 Jan. - 15 Mar. 1972
15 Mar. 1972 194 p refs
(Contract NAS8-28429)
(NASA-CR-123620; LPC-629-6-Vol-2-Bk-1) Avail: NTIS CSCL 21H

An analysis of the factors which determined the selection of the solid rocket propellant engines for the space shuttle booster is presented. The 156 inch diameter, parallel burn engine was selected because of its transportability, cost effectiveness, and reliability. Other factors which caused favorable consideration are: (1) recovery and reuse are feasible and offer substantial cost savings, (2) abort can be easily accomplished, and (3) ecological effects are acceptable.
Author

N72-22776*# Lockheed Propulsion Co., Redlands, Calif.
STUDY OF SOLID ROCKET MOTORS FOR A SPACE SHUTTLE BOOSTER. VOLUME 2 BOOK 2: SUPPORTING RESEARCH AND TECHNOLOGY Final Report, 13 Jan. 15 Mar. 1972
A. H. VonDeresch 15 Mar. 1972 51 p refs
(Contract NAS8-28429)
(NASA-CR-123615; LPC-629-6-Vol-2-BK-2) Avail: NTIS CSCL 21H

The baseline SRM design for the space shuttle employs proven technology based on actual motor firings. Supporting research and technology are therefore required only to address system technology that is specific to the shuttle requirements, and that is needed for optimization of design features. Eight programs are recommended to meet these requirements.
Author

N72-22777*# Lockheed Propulsion Co., Redlands, Calif.
STUDY OF SOLID ROCKET MOTORS FOR A SPACE SHUTTLE BOOSTER. VOLUME 2, BOOK 3: COST ESTIMATING DATA Final Report, 13 Jan. - 15 Mar. 1972
A. H. Vanderesch 15 Mar. 1972 168 p
(Contract NAS8-28429)
(NASA-CR-123617; LPC-629-6-vol-2-Bk-3) Avail: NTIS CSCL 22H

Cost estimating data for the 156 inch diameter, parallel burn solid rocket propellant engine selected for the space shuttle booster are presented. The costing aspects on the baseline motor are initially considered. From the baseline, sufficient data is obtained to provide cost estimates of alternate approaches.
Author

N72-22778*# Lockheed Propulsion Co., Redlands, Calif.
STUDY OF SOLID ROCKET MOTORS FOR A SPACE SHUTTLE BOOSTER. VOLUME 2, BOOK 3, ADDENDUM 1: COST ESTIMATING DATA Final Report, 13 Jan. 15 Mar. 1972
A. H. VonDerEsch 15 Mar. 1972 40 p refs Revised
(Contract NAS8-28429)
(NASA-CR-123618; LPC-629-6-Vol-2-Bk-3-Add-1) Avail: NTIS CSCL 21H

A second iteration of the program baseline configuration and cost for the solid propellant rocket engines used with the space shuttle booster system is presented. The purpose of the study was to ensure that total program costs were complete and to review areas where costs might be overly conservative and could be reduced. Labor and material were analyzed in more depth, more definition was prepared to separate recurring from nonrecurring costs, and the operations portions of the engine and stage were separated into more identifiable activities.
Author

N72-22779*# Lockheed Propulsion Co., Redlands, Calif.
STUDY OF SOLID ROCKET MOTORS FOR A SPACE SHUTTLE BOOSTER. VOLUME 3: PROGRAM ACQUISITION PLANNING Final Report, 13 Jan. - 15 Mar. 1972
A. H. VonDerEsch 15 Mar. 1972 84 p refs
(Contract NAS8-28429)
(NASA-CR-123619; LPC-629-6-Vol-3) Avail: NTIS CSCL 21H

Plans for conducting Phase C/D for a solid rocket motor booster vehicle are presented. Methods for conducting this program with details of scheduling, testing, and program management and control are included. The requirements of the space shuttle program to deliver a minimum cost/maximum reliability booster vehicle are examined.
Author

N72-22780*# Lockheed Propulsion Co., Redlands, Calif.
STUDY OF SOLID ROCKET MOTORS FOR A SPACE SHUTTLE BOOSTER. VOLUME 4: MASS PROPERTIES REPORT Final Report, 13 Jan. - 15 Mar. 1972
A. H. VonDerEsch 15 Mar. 1972 8 p
(Contract NAS8-28429)
(NASA-CR-123616; LPC-629-6-Vol-4) Avail: NTIS CSCL 21H

Mass properties data for the 156 inch diameter, parallel burn, solid propellant rocket engine for the space shuttle booster are presented. Design ground rules and assumptions applicable to generation of the mass properties data are described, together with pertinent data sources. Author

N72-22781*# TRW Systems Group, Redondo Beach, Calif.
FEASIBILITY STUDY OF A PRESSURE-FED ENGINE FOR A WATER RECOVERABLE SPACE SHUTTLE BOOSTER
E. Gerstl [1972] 28 p
(Contract NAS8-28218)
(NASA-CR-123604; SE-019-015-2H; DRD-SE-03) Avail: NTIS CSCL 21H

Detailed mass properties are presented for a gimbaled, fixed thrust, regeneratively cooled engine having a coaxial pintle injector. The baseline design parameters for this engine are tabulated. Mass properties are also summarized for several other engine configurations i.e., a hinge nozzle using a Techroll seal, a gimbaled duct cooled engine and a regeneratively cooled engine using liquid injection thrust vector control (LITVC). Detailed engine analysis and design trade studies leading to the selection of a regeneratively cooled gimbaled engine and pertaining to the selection of the baseline design configuration are also given. Author

N72-22782*# TRW Systems Group, Redondo Beach, Calif.
FEASIBILITY STUDY OF A PRESSURE-FED ENGINE FOR A WATER RECOVERABLE SPACE SHUTTLE BOOSTER
W. M. King 15 Mar. 1972 121 p
(Contract NAS8-28218)
(NASA-CR-123605; SE-019-013-2H; DRD-SE-02) Avail: NTIS CSCL 21H

For abstract, see TN 15295

N72-22783*# Aerojet Solid Propulsion Co., Sacramento, Calif.
MASS PROPERTIES REPORT ON 156-INCH DIAMETER SRM
10 Mar. 1972 18 p
(Contract NAS8-28428)
(NASA-CR-123613; Rept-1917-MP1) Avail: NTIS CSCL 21H

Mass properties data for 156-in.-dia SRM booster with two segments are presented. The SRM baseline booster has a fixed 15 degrees canted nozzle and no thrust neutralization system. Summary mass properties data for alternative booster configurations are included. Author

N72-22784*# United Technology Center, Sunnyvale, Calif.
STUDY OF SOLID ROCKET MOTORS FOR A SPACE SHUTTLE BOOSTER. VOLUME 1: EXECUTIVE SUMMARY Final Report
15 Mar. 1972 41 p
(Contract NAS8-28431)
(NASA-CR-123623; UTC-4205-72-7-Vol-1) Avail: NTIS CSCL 21H

The design, development, production, and launch support analysis for determining the solid propellant rocket engine to be used with the space shuttle are discussed. Specific program objectives considered were: (1) definition of engine designs to satisfy the performance and configuration requirements of the various vehicle/booster concepts, (2) definition of requirements to produce booster stages at rates of 60, 40, 20, and 10 launches per year in a man-rated system, and (3) estimation of costs for the defined SRM booster stages. Author

N72-22785*# United Technology Center, Sunnyvale, Calif.
STUDY OF SOLID ROCKET MOTORS FOR A SPACE SHUTTLE BOOSTER. VOLUME 2: TECHNICAL REPORT Final Report
15 Mar. 1972 359 p
(Contract NAS8-28431)
(NASA-CR-123528; UTC-4205-72-7-Vol-2) Avail: NTIS HC $6.00/MF $0.95 CSCL 21H

For Abstract see N72-22784

N72-22786*# United Technology Center, Sunnyvale, Calif.
STUDY OF SOLID ROCKET MOTORS FOR A SPACE SHUTTLE BOOSTER. APPENDIX A: SOLID ROCKET MOTOR PROGRAM COST ESTIMATE Final Report
15 Mar. 1972 48 p
(Contract NAS8-28431)
(NASA-CR-123621; UTC-4205-72-7-App-A) Avail: NTIS CSCL 21H

The SRM booster stage program cost estimate and time-phased funding requirements are presented in tabular form. Graphs on parametric analysis are also considered. J.A.M.

N72-22787*# United Technology Center, Sunnyvale, Calif.
STUDY OF SOLID ROCKET MOTORS FOR A SPACE SHUTTLE BOOSTER. APPENDIX B: PRIME ITEM DEVELOPMENT SPECIFICATION Final Report
15 Mar. 1972 87 p ref
(Contract NAS8-28431)
(NASA-CR-123527; UTC-4205-72-7-App-B) Avail: NTIS CSCL 21H

The specifications for the performance, design, development, and test requirements of the P2-156, S3-156, and S6-120 space shuttle booster solid rocket motors are presented. The applicable documents which form a part of the specifications are listed. F.O.S.

N72-22788*# United Technology Center, Sunnyvale, Calif.
STUDY OF SOLID ROCKET MOTORS FOR A SPACE SHUTTLE BOOSTER. APPENDIX C: RECOVERY AND REUSE 120-INCH DIAMETER SOLID ROCKET MOTOR BOOSTERS Final Report
15 Mar. 1972 44 p
(Contract NAS8-28431)
(NASA-CR-123622; UTC-4205-72-7-App-C) Avail: NTIS CSCL 21H

A baseline for a space shuttle configuration utilizing four parallel-burn 120-in. diameter SRMS is presented. Topics discussed include parachute system sequence, recovery system development profile, parachute container, and segment and closure recovery operations. A cost analysis for recovery of the SRM stage is presented. It is concluded that from the standpoint of minimum cost and development, parachutes are the best means of achieving SRM recovery. Major SRM components can be reused safely. F.O.S.

N72-22789*# United Technology Center, Sunnyvale, Calif.
STUDY OF SOLID ROCKET MOTORS FOR A SPACE SHUTTLE BOOSTER. APPENDIX D: RECOVERY AND REUSE 156-INCH DIAMETER SOLID ROCKET MOTOR BOOSTER Final Report
15 Mar. 1972 45 p
(Contract NAS8-28431)
(NASA-CR-123625; UTC-4205-72-7-App-D) Avail: NTIS CSCL 21H

The baseline for a space shuttle configuration utilizing two parallel-burn, 156-in.-diameter SRMs with three segments and techroll seal movable nozzles is presented. The concept and general economic benefits of SRM recovery are equally valid for the series-burn SRMs, provided that those SRMs are also designed for the same strength, stiffness, segmentation, and interchangeability as the present design, and that those SRMs are also recovered as individual units. Feasibility studies were

initiated to investigate SRM recoverability. These studies were based upon recovery of the SRM boosters for the Titan 3C. Ground rules precluded SRM modification that required significant changes in motor qualification or schedule. Even with this restriction, the study determined that the recoverable booster concept was completely feasible, both technically and economically. Parachute recovery has been selected as the best method, principally because it can accomplish the task with a minimum development cost and time to achieve operational recovery status. This system affords the highest probability for achieving large cost reductions. Author

N72-22790*# United Technology Center, Sunnyvale, Calif.
STUDY OF SOLID ROCKET MOTORS FOR A SPACE SHUTTLE BOOSTER. APPENDIX E: ENVIRONMENTAL IMPACT STATEMENT, SOLID ROCKET MOTOR, SPACE SHUTTLE BOOSTER Final Report
15 Mar. 1972 11 p
(Contract NAS8-28431)
(NASA-CR-123526; UTC-4205-72-7-App-E) Avail: NTIS CSCL 21H

An analysis of the combustion products resulting from the solid propellant rocket engines of the space shuttle booster is presented. Calculation of the degree of pollution indicates that the only potentially harmful pollutants, carbon monoxide and hydrochloric acid, will be too diluted to constitute a hazard. The mass of products ejected during a launch within the troposphere is insignificant in terms of similar materials that enter the atmosphere from other sources. Noise pollution will not exceed that obtained from the Saturn 5 launch vehicle. Author

N72-22791*# Pratt and Whitney Aircraft, West Palm Beach, Fla. Florida Research and Development Center.
SINGLE-STAGE EXPERIMENTAL EVALUATION OF COMPRESSOR BLADING WITH SLOTS AND VORTEX GENERATORS, PART 5 Final Report
J. A. Brent 31 Mar. 1972 135 p refs
(Contract NAS3-10481)
(NASA-CR-72793; PWA-FR-4541-Pt-5) Avail: NTIS CSCL 21E

An experimental investigation was conducted to determine the extent that slots and vortex generators can increase the efficiency and stable operating range of highly loaded compressor stages. With slots in the rotor and stator, the stage performance both with and without vortex generators was inferior to that achieved with the unslotted blading. However, with vortex generators, stator slots, and an unslotted rotor, the stable operating range increased 25% and the stage peak efficiency increased 2.1% over the values achieved with the unslotted rotor and stator without vortex generators, at design equivalent rotor speed. Author

N72-22792*# Pratt and Whitney Aircraft, West Palm Beach, Fla. Research and Development Center.
DEVELOPMENT OF A SHORT LENGTH COMBUSTOR FOR A SUPERSONIC CRUISE TURBOFAN ENGINE USING A 90 DEG SECTOR OF A FULL ANNULUS Interim Report, Apr. 1970 - Aug. 1971
T. R. Clements Apr. 1972 45 p refs
(Contract NAS3-11159)
(NASA-CR-120908; PWA-FR-4854; IR-2) Avail: NTIS CSCL 21H

A performance development program has been conducted on a short length, double-annular, ram-induction combustor. The combustor was designed for a large augmented turbofan engine capable of sustained flight speeds up to Mach 3.0. Performance tests were conducted at an inlet temperature and Mach number simulating engine sea level takeoff conditions. At the design temperature rise of 1600 F, combustion efficiency was 100%, pattern factor was 0.20, and combined diffuser-combustor pressure loss was 4.4% or 1.12 times the diffuser inlet velocity head. A temperature rise in excess of 2400 F with a combustion efficiency of 94% was demonstrated. Author

N72-22793*# Pratt and Whitney Aircraft, East Hartford, Conn.
SINGLE-STAGE EVALUATION OF HIGHLY-LOADED HIGH-MACH-NUMBER COMPRESSOR STAGES 5. DATA AND PERFORMANCE OF BASELINE, CORNER-BLOW WALL SUCTION AND COMBINED CORNER BLOW WALL SUCTION STATOR
J. P. Nikkanen and J. P. Brooky Mar. 1972 261 p refs
(Contract NAS3-10482)
(NASA-CR-120887; PWA-4312) Avail: NTIS CSCL 21E

A single-stage compressor with a rotor tip speed of 1600 ft/sec and a 0.5 hub tip ratio was used to investigate the effects of several stator endwall treatment methods on stage range and performance. These endwall treatment methods consisted of stator corner-blow, annular wall suction upstream of stator leading edge, and combined corner-blow and annular wall suction. The overall stage performance with corner blow was essentially the same as the baseline performance. The performance for the annular wall suction and the combined corner-blow and wall suction showed a reduction in peak efficiency of 2.5 percentage points compared to the baseline data. Author

N72-22794*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESIGN AND TEST OF POROUS-TUNGSTEN MERCURY VAPORIZERS
William R. Kerslake Washington Apr. 1972 29 p refs
(NASA-TN-D-6782; E-6792) Avail: NTIS CSCL 21C

New design requirements for porous plug-type vaporizers used with Kaufman thrusters and thruster arrays are discussed. The results of testing samples of porous tungsten for mercury flow rate, liquid intrusion pressure level, and mechanical strength are presented. Nitrogen gas was used instead of mercury vapor for approximate calibration. Liquid intrusion pressure levels will require that flight thruster systems with long feedlines have restrictions in the dynamic line during launch. Author

N72-22795*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF THE EFFECT OF ENGINE CHARACTERISTICS ON THE EXTERNAL AERODYNAMICS OF STOL WING PROPULSION SYSTEMS
James A. Albers Washington Apr. 1972 19 p refs
(NASA-TM-X-2541; E-6757) Avail: NTIS CSCL 21E

The effects of engine presssure ratio, engine size, and engine location on the pressure distribution, lift coefficient, and flow field of a STOL wing propulsion system are presented. The flow variables of the engines are included in the two-dimensional potential flow analysis by considering the effects of mass flow coefficient at the engine inlet and thrust coefficient at the engine exit. A functional relation between these coefficients and engine pressure ratio is given. The results of this study indicate that the effect of engine pressure ratio on the external aerodynamics is a function of engine location. For engines located on the bottom of the wing, the highest pressure ratio engine resulted in the highest lift coefficient. For engines located on the top of the wing, the lowest pressure ratio engine resulted in the highest lift coefficient. Author

N72-22796*# TRW Systems Group, Redondo Beach, Calif.
MONOPROPELLANT HYDRAZINE RESISTOJET PRELIMINARY DESIGN TASK Summary Report
Charles K. Murch Feb. 1972 43 p ref
(Contract NAS5-11477)
(NASA-CR-122376; TRW-20266-6009-R0-00) Avail: NTIS CSCL 21H

The design effort for the electrothermal hydrazine thruster (ETH) is summarized. The EHT decomposes hydrazine thermally and expands the decomposition products through a nozzle to provide the impulse necessary to fulfill spacecraft propulsive requirements. The thruster is capable of operation at pulse widths from 0.050 second to steady state and delivers specific impulse values from 175 to greater than 225 seconds, depending upon the duty cycle. The design of the EHT is the result of an

analytical effort combined with a series of design verification tests. The design requirements, design philosophy and detailed design methods are outlined. A discussion of the rationale behind the selection of materials for the EHT is included. The results of the design verification tests are also presented. Author

N72-22797*# Avco Corp., Wilmington, Mass. Systems Div.
EVALUATION OF A PULSED QUASI-STEADY MPD THRUSTER AND ASSOCIATED SUBSYSTEMS Final Technical Report
H. Lien, R. L. Garrison, and D. R. Libby Feb. 1972 242 p refs
(Contract NAS1-10813)
(NASA-CR-112027; AVSD-0146-72-RR) Avail: NTIS CSCL 21C

The performance of quasi-steady magnetoplasmadynamic (MPD) thrusters at high power levels is discussed. An axisymmetric configuration is used for the MPD thruster, with various cathode and anode sizes, over a wide range of experimental conditions. Thrust is determined from impulse measurements with current waveforms, while instantaeous measurements are made for all other variables. It is demonstrated that the thrust produced has a predominately self-magnetic origin and is directly proportional to the square of the current. The complete set of impulse measurement data is presented. Author

N72-22798# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
GAS TURBINE CYCLE CALCULATIONS: EXPERIMENTAL VERIFICATION OF OFF-DESIGN-POINT PERFORMANCE PREDICTIONS FOR A TWO-SPOOL TURBOJET WITH VARIOUS AIR BLEEDS
M. S. Chappell and W. Grabe Nov. 1971 76 p refs
(LR-555; NRC-12475) Avail: NTIS

A simplified method for calculating off-design-point performance of turbojet and turbofan engines, both at sea level and at altitude conditions, is presented. The method implies constancy of component efficiencies and linearity of corrected mass flow with corrected engine speed. Data were gathered on a j-75 two spool turbojet engine at part throttle conditions, with compressor bleed extraction, and with propelling nozzle area change. The calculations were found to be accurate for part throttle performance, but less successful for the other conditions. Author

N72-22799*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF THE EFFECT OF TWO DAMPER SIZES ON THE PERFORMANCE OF A LOW-SOLIDITY AXIAL-FLOW TRANSONIC COMPRESSOR ROTOR
George W. Lewis, Jr. and Donald C. Urasek Washington Apr. 1972 89 p refs
(NASA-TM-X-2536; E-6536) Avail: NTIS CSCL 21E

The experimental performance of a 20-inch-diameter axial-flow transonic compressor rotor with small dampers is presented. The compressor rotor was tested earlier with large dampers which were twice in size, and comparisons of overall performance and radial distributions of selected flow and performance parameters are made. The rotor with small dampers experienced lower losses in the damper region which resulted in locally higher values of temperature rise efficiency and total pressure ratio. However, there was no appreciable effect on overall efficiency and pressure ratio. A greater stall margin was measured for the rotor with small dampers at design speed, but at 70 and 90 percent of design speed the rotor with large dampers had somewhat greater flow range. Author

N72-22800# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NEW POSSIBILITIES OF APPLYING HOLLOW GUIDE WAVES TO INCREASE THE EFFICIENCY OF A TURBO-JET
W. R. Gundlach and J. Prochnicki 3 Dec. 1971 14 p Transl. into ENGLISH from Polska Akad. Nauk, Inst. Maszyn Przepiywowych, Prace (Warsaw), no. 42, 1970 p 503-511
(AF Proj. 6040)
(AD-736402; FTD-HT-23-1089-71) Avail: NTIS CSCL 21/5

A new approach to the arrangement of steam bleeds for recuperative feed water heating is suggested. According to the project, steam extraction should take place both at outer and inner perimeter of the annulus of steam admission to guide wheel (all over the circumference), steam bled at the inner perimeter being led outside though hollow guide vanes. Experiments were carried out on an expecially adapted test rig to explain the influence of such steam bleeding on the magnitude of end losses. The relative steam bleeding has been considered as a parameter. Author (GRA)

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation, and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N72-22801 Washington Univ., Seattle.
A SEARCH FOR DISCRETE CELESTIAL SOURCES OF FAR-INFRARED RADIATION Ph.D. Thesis
Robert David Joseph 1971 119 p
Avail: Univ. Microfilms Order No. 71-19819

Considerations pertinent to the experimental design of the observation, and special complications attending the necessity for making these observations with telescope and detector lofted well into the stratosphere by balloon are discussed. A gondola equipped with a Ge:Ga bolometer, cooled to the temperature of liquid helium, at the focus of an eight-inch Newtonian telescope, is described. This instrument was flown at 28 km altitude for 12 hours on 21 to 22 January 1970, in an attempt to search the sky for discrete source radiating strongly at wavelengths between 45 and 300 microns. The data from this flight, and methods of its reduction are presented. Four sources of apparent flux approximately 10 to the minus 13th power watt/sq cm were detected. Their celestial positions are not uniquely identifiable with sources prominent in other spectral regions. Dissert. Abstr.

N72-22802 Washington Univ., Seattle.
SOLAR WIND FOR A MAGNETIZED PLASMA WITH TENSOR PLASMA PRESSURE Ph.D. Thesis
Muser Mu-shen Tan 1971 130 p
Avail: Univ. Microfilms Order No. 71-19847

A model of the quiet day solar wind is presented, including a self-consistent magnetic field, an azimuthal flow velocity and an anisotropic plasma pressure. The fully ionized solar wind plasma consisting of 95.5% hydrogen ions, 4.5% helium ions and electrons is described by the hydromagnetic equations for a collisionless plasma in a strong magnetic field. These equations are a variation of the Chew-Goldberger-Low equations where new polytrope laws, functions of mass density and magnetic field magnitude, replace the energy equation. The precise form of the energy equation is unknown since the solar wind heating by mechanical waves is only understood qualitatively. The polytrope laws are chosen to reduce to the CGL double adiabatic equations of state in one limit and to the isothermal equation of state in another limit affording a relatively easy comparison with previous models. The choice also makes the momentum equation integrable. Dissert. Abstr.

N72-22803*# Stanford Univ., Calif. Inst. for Plasma Research.
THE STRUCTURE AND HEATING OF THE CHROMOSPHERE-CORONA TRANSITION REGION
R. L. Moore Mar. 1972 144 p refs
(Grant NGL-05-020-272; Contract F44620-69-C-0008)
(NASA-CR-126134; SU-IPR-463) Avail: NTIS CSCL 03B

The structure and heating (or energy balance) of the

transition region and the role of the transition region in the structure and heating of the solar atmosphere as a whole are investigated. The features of the structure of the atmosphere and radiative energy losses of the atmosphere are summarized. A static, planar model of the solar temperature which has a temperature profile representative of the actual solar atmosphere is considered. Then a static, planar model of the transition region which is heated by thermal conduction from the corona and cooled by radiative losses is developed. A general conclusion is that the temperature profile of the transition region and lower corona results primarily from the energy balance of the corona, while the number density is determined by the energy balance of the transition region. Author

N72-22804*# Scientific Translation Service, Santa Barbara, Calif.
SOLAR-DIURNAL VARIATIONS OF COSMIC RAYS FROM THE MAXIMUM TO THE MINIMUM OF SOLAR ACTIVITY
L. I. Dorman and Ye. V. Kolomeyets Apr. 1972 169 p refs Transl. into ENGLISH from Kosmicheskiye Luchi (Moscow), no. 9, 1968 p 1-109
(Contract NASw-2035)
(NASA-TT-F-690) Avail: NTIS CSCL 03B

The planetary distribution and energy dependence of the first and second harmonics of the solar-diurnal variation of cosmic rays in the quiet and disturbed periods are analyzed according to the data of the world network of neutron monitors for the observation period 1957 to 1964, i.e., for the period from the maximum to the minimum of solar activity. The anisotropy of cosmic rays is a sensitive characteristic of the changing conditions in interplanetary space. On the basis of the obtained data, a critical analysis is conducted of the mechanisms which cause anisotropy of the galactic cosmic rays in the solar system. A model of the solar-diurnal variations of cosmic rays is developed from the theory of anisotropic diffusion of particles on the moving irregularities of the interplanetary magnetic field in the presence of a regular field, with different directions of the field with force lines in the form of the Archimedes spirals.
Author

N72-22805# Lund Univ. (Sweden). Dept. of Physics.
USE OF ILFORD K2 NUCLEAR EMULSIONS IN STUDIES OF THE COSMIC RAY CHARGE SPECTRUM
R. Rosanoer Nov. 1971 25 p refs
(LUIP-CR-71-7) Avail: AEC Depository Libraries

Photometric mean track width measurements were carried out on about 200 primary cosmic ray particles ($5 < \text{or} = Z < \text{or} = 26$), stopping in an Ilford K2 emulsion stack. The standard deviation of the experimentally determined charge values is about 0.3 units of charge in the whole spectrum, when the residual range interval 0.5 to 10.5 mm was used for identification. The resolution compares as well with the charge resolution obtained with other types of cosmic ray detectors.
Author (NSA)

N72-22806# California Inst. of Tech., Pasadena.
MAGNETIC AND VELOCITY CONFIGURATIONS IN THE SOLAR ATMOSPHERE Final Report, 15 Nov. 1969 - 14 May 1971
Edwin W. Dennison and Robert F. Howard 4 Aug. 1971 10 p
(Contract F19628-70-C-0133)
(AD-736463; AFCRL-71-0483) Avail: NTIS CSCL 03/2

A powerful data-reduction system has been constructed to aid in the solution of important problems involving magnetic and velocity fields on the surface of the sun. In the near future this system, coupled to telescope control and data acquisition systems now being built, will be moved to the 150-foot solar tower telescope at Mount Wilson where it will provide astronomers with a powerful new tool for research in solar physics.
Author (GRA)

N72-22309*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RADIATION SCALES ON WHICH STANDARD VALUES OF THE SOLAR CONSTANT AND SOLAR SPECTRAL IRRADIANCE ARE BASED
Matthew P. Thekaekara *In its* Space Simulation 1972 p 947-953 refs (See N72-22250 13-11)
(Paper-81) Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 03B

N72-22310*# Institute of Environmental Sciences, Washington, D.C. Solar Radiation Committee.
PROPOSED SPECIFICATION FOR THE SOLAR CONSTANT AND AIR MASS ZERO SOLAR SPECTRAL IRRADIANCE
In NASA. Goddard Space Flight Center Space Simulation 1972 p 955-968 refs Prepared in cooperation with Am. Soc. for Testing and Mater., Philadelphia, Pa. (See N72-22250 13-11)
(Paper-82) Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 03B

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N72-22807*# California Univ., Berkeley. Dept. of Astronomy and Space Sciences Lab.
THE SPECTRA OF TEN GALACTIC X-RAY SOURCES IN THE SOUTHERN SKY
Ray Cruddace, Stuart Bowyer, Michael Lampton, John Mack, and Bruce Margon Oct. 1971 35 p refs
(Grant NGR-05-003-278)
(NASA-CR-126169; Ser-12-Issue-74) Avail: NTIS CSCL 03B

Data on ten galactic X-ray sources were obtained during a rocket flight from Brazil in June 1969. Detailed spectra of these sources have been compared with bremsstrahlung, black body, and power law models, each including interstellar absorption. Six of the sources were fitted well by one or more of these models. In only one case were the data sufficient to distinguish the best model. Three of the sources were not fitted by any of the models, which suggests that more complex emission mechanisms are applicable. A comparison of our results with those of previous investigations provides evidence that five of the sources vary in intensity by a factor of 2 or more, and that three have variable spectra. New or substantially improved positions have been derived for four of the sources observed. Author

N72-22808*# California Univ., Berkeley. Space Sciences Lab.
LIMITS ON INTERGALACTIC HELIUM FROM THE 3C 273 X-RAY SPECTRUM
Bruce Margon, Stuart Bowyer, and Michael Lampton Feb. 1972 14 p refs Submitted for publication
(Grant NGR-05-003-278)
(NASA-CR-126310; SSL-Ser-13-Issue-2) Avail: NTIS CSCL 03B

An X-ray spectrum of the quasi-stellar object 3C 273 in the interval 0.25 to 10 KeV was obtained by sounding rocket observations. The best-fit power law spectrum has photon index $n = 1.3$ with no photoelectric absorption. An upper limit on the X-ray optical depth to 3C 273 was calculated from the data, permitting upper limits to be set on the absolute abundance of helium in the intergalactic medium. Author

N72-22809*# Israel Program for Scientific Translations, Ltd., Jerusalem.
INTERPLANETARY FLIGHT AND COMMUNICATION.

VOLUME 3, NO. 8: THEORY OF SPACE FLIGHT
Nikolai Alekseevich Rynin 1971 346 p refs Transl. into ENGLISH of the publ. "Mezhplanetnye Soobshcheniya: Teoriya Kosmicheskogo Poleta" Leningrad, Izd.-vo Akad. Nauk SSSR, 1932 Sponsored by NASA and NSF
(NASA-TT-F-647; TT70-50118) Avail: NTIS HC $6.00/MF $0.95 CSCL 22A

A collection of classical works on space flight, published prior to 1932, is presented. Rocket motion, interplanetary flight and planetary landings, flights to the moon, astronaut intravehicular and extravehicular activity, and rocket sounding of the upper atmosphere are covered. The authors include Robert Esnault-Pelterie, Robert Goddard, Hermann Oberth, Walter Homann, Hans Lorenz, A. Shershevskii, and Julius Kuntz. It is pointed out that different people in different countries independently came to the conclusion that interplanetary travel was feasible but impracticable at that time because of technical and financial difficulties. N.E.N.

N72-22810*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
INFRARED ABSORPTION OF CARBON DIOXIDE AT HIGH DENSITIES WITH APPLICATION TO THE ATMOSPHERE OF VENUS Ph.D. Thesis - Columbia Univ.
John Fitzallen Moore Greenbelt, Md. Dec. 1971 143 p refs
(NASA-TM-X-65863; X-630-72-48) Avail: NTIS CSCL 03B

Several new infrared absorptions were found in carbon dioxide. All are normally forbidden, and were collision-induced in an absorbing cell whose combination of pressure and path length has a unique sensitivity for induced absorptions. The new absorptions in the 2.3 micron region are attributed to transitions from ground to the 3(1)1 Fermi pair at 4248 and 4391/cm. Other absorptions are attributed to simultaneous CO2-N2 transitions and to the 00(0)0-00(0)2 transition in CO2 polarizability derivatives and regular progressions in strength versus increasing quantum number. The spectra were used to predict the radiative transfer in a dry CO2 model of the lower Venus atmosphere. The results indicate that the radiation balance in the lower atmosphere is adequately explained by a dry massive atmosphere of CO2 with a layer of infrared-opaque clouds. The absorptions in the 2.3 micron region are significant in accounting for the opacity to sustain Venus' 768 K surface temperature. Author

N72-22811# Lowell Observatory, Flagstaff, Ariz.
A PROPER MOTION SURVEY AT THE SOUTH GALACTIC POLE
H. L. Giclas, R. Burnham, Jr., and N. G. Thomas 1 Mar. 1972 38 p refs Sponsored by NSF
(Bull-158) Avail: NTIS

The first results are presented for the extension of the Lowell proper motion survey into the Southern Hemisphere. A special study, to a limit of motion of 0.20 sec/year instead of the usual limit of 0.27 sec/year, was undertaken on the four regions G266 through G269. These four regions, covering an area of about 550 square degrees, are centered around the South Galactic Pole. Data are summarized for the motion stars found between the magnitude limits of 8 and 17, and with motions greater than 0.19 sec/year. Finder charts are provided for each star listed. A supplementary list of 135 white dwarf suspects and a list of 47 very red stars with motions below our adopted program limit of 0.20 sec/year are also included. Author

N72-22812*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
RADIOACTIVITY IN RETURNED LUNAR MATERIALS Semiannual Progress Report, 1 Aug. 1971 - 31 Jan. 1972
Feb. 1972 26 p refs
(Grant NGR-09-015-145)
(NASA-CR-115503; SAPR-2) Avail: NTIS CSCL 03B

The H-3, Ar-37, and Ar-39 radioactivities were measured at several depths in the large documented lunar rocks 14321 and 15555. The comparison of the Ar-37 activities from similar locations in rocks 12002, 14321, and 15555 gives direct measures of the amount of Ar-37 produced by the 2 November 1969 and 24 January 1971 solar flares. The tritium contents in the documented rocks decreased with increasing depths. The solar flare intensity averaged over 30 years obtained from the tritium depth dependence was approximately the same as the flare intensity averaged over 1000 years obtained from the Ar-37 measurements. Radioactivities in two Apollo 15 soil samples, H-3 in several Surveyor 3 samples, and tritium and radon weepage were also measured. Author

N72-22813# National Aerospace Lab., Tokyo (Japan).
THE STUDY OF THE MOTION OF AN ARTIFICIAL SATELLITE IN THE EARTH'S GRAVITATIONAL FIELD
Sumio Takeuchi and Koichi Matsushima Dec. 1971 36 p refs In JAPANESE, ENGLISH summary
(NAL-TR-255) Avail: NTIS

A first order perturbation method was obtained for analyzing the motion of an artificial satellite in the earth's gravitational field, using Lagrange's planetary equations. The infinite order harmonics were taken into consideration in the disturbing function, due to the asphericity of the earth, and resonance conditions were confined to the state of exact commensurability. The perturbations of orbital elements were separated into two components: long range short period perturbations. The perturbations of the synchronous satellite were analyzed. Author

N72-22814*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO 15 PRELIMINARY SCIENCE REPORT
Washington 1972 502 p refs Original contains color illustrations
(NASA-SP-289; LC-72-185106) Avail: NTIS; SOD $8.00 CSCL 22A

The Apollo 15 flight and lunar landing is discussed with emphasis on the scientific endeavors conducted on the lunar surface. The activities of the mission are presented in three phases: (1) the orbital experiments, (2) the package of lunar surface experiments, and (3) the surface sampling and observation. The Apollo 15 scientific activities involved collecting a lunar surface contingency sample and conducting 11 lunar surface experiments, 11 lunar orbital experiments, service module orbital tasks, and command module photographic tasks. For individual titles, see N72-22815 through N72-22858.

N72-22815*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
MISSION DESCRIPTION
Richard R. Baldwin *In its* Apollo 15 Prelim. Sci. Rept. 1972 11 p ref (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 22A

The Apollo 15 manned lunar-landing mission is discussed. As compared with previous Apollo manned lunar-landing missions, the mission 15 is characterized by increased hardware capability, a larger scientific payload, and a battery-powered lunar roving vehicle (Rover). Benefits resulting from these additions to Apollo 15 were a mission duration of 12-1/3 days, a lunar stay time of nearly 67 hr, a lunar-surface traverse distance of 27.9 km traveled at an average speed of 9.6 km/hr, and a scientific instrument module (SIM) containing equipment for orbital experiments and photographic tasks not performed on previous missions. The primary scientific objectives of the mission were to perform selenological inspection, survey, and sampling of materials and surface features in a preselected area of the Hadley-Apennine region; to emplace and activate surface experiments; and to conduct inflight experiments and photographic tasks from lunar orbit. Author

N72-22816*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SUMMARY OF SCIENTIFIC RESULTS
Joseph P. Allen *In its* Apollo 15 Prelim. Sci. Rept. 1972

12 p refs (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 22A

The major scientific results of the Apollo 15 flight are summarized. The objectives of the flight are given as: (1) to carry out extensive geological exploration, comprehensive sampling, and photographic documentation of the Apennine Front at Hadley Delta, Hadley Rille, and the mare plain, (2) to emplace the ALSEP near the landing site, and (3) to perform a series of survey experiments with the scientific instrument module (SIM) equipment from lunar orbit and during transearth coast. Author

N72-22817*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
PHOTOGRAPHIC SUMMARY
John W. Dietrich and Uel S. Clanton *In its* Apollo 15 Prelim. Sci. Rept. 1972 32 p Original contains color illustrations (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 22A

The photographic objectives of the Apollo 15 mission were designed to support a wide variety of scientific and operational experiments, to provide high-resolution panoramic photographs and precisely oriented metric photographs of the lunar surface, and to document operational tasks on the lunar surface and in flight. Detailed premission planning integrated the photographic tasks with the other mission objectives to produce a balanced mission that has returned more data than any previous space voyage. The return of photographic data was enhanced by new equipment, the high latitude of the landing site, and greater time in lunar orbit. New camera systems that were mounted in the scientific instrument module (SIM) bay of the service module provided a major photographic capability that was not available on any previous lunar mission, manned or unmanned. Author

N72-22818*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
CREW OBSERVATIONS
David R. Scott, Alfred M. Worden, and James B. Irwin *In its* Apollo 15 Prelim. Sci. Rept. 1972 4 p (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 22A

Crew observations of the Apollo 15 flight are presented. The observations are concerned with the following phases of the flight: (1) translunar and transearth coasts, (2) lunar landing and ascent, (3) standup extravehicular activity, (4) surface experiment deployment, (5) lunar traverse geology, and (6) orbital observations. Author

N72-22819*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
PRELIMINARY GEOLOGIC INVESTIGATION OF THE APOLLO 15 LANDING SITE
G. A. Swann, N. G. Bailey, R. M. Batson, V. L. Freeman, M. H. Hait, J. W. Head, H. E. Holt, K. A. Howard, J. B. Irwin, K. B. Larson et al *In its* Apollo 15 Prelim. Sci. Rept. 1972 112 p refs Prepared in cooperation with Bellcomm, Inc., Geol. Survey, Washington, D. C., Texas Univ., Austin, and Calif. Inst. of Technol., Pasadena (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 22A

The Apollo 15 lunar module (LM) landed on the mare surface of Palus Putredinis on the eastern edge of the Imbrium Basin. The site is between the Apennine Mountain front and Hadley Rille. The objectives of the mission, in order of decreasing priority, were description and sampling of three major geologic features-the Apennine Front, Hadley Rille, and the mare. The greater number of periods of extravehicular activity (EVA) and the mobility provided by the lunar roving vehicle (ROVER) allowed much more geologic information to be obtained from a much larger area than those explored by previous Apollo crews. A total of 5 hours was spent at traverse station stops, and the astronauts transmitted excellent descriptions of the lunar surface while in transit between stations. Author

N72-22820*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
PRELIMINARY EXAMINATION OF LUNAR SAMPLES
In its Apollo 15 Prelim. Sci. Rept. 1972 25 p refs (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 22A

The morphology, mineralogy, petrology, and chemistry of the samples returned from the Apollo 15 landing site are discussed. A selenological description of the area from which the samples were taken is given. The diversity of the samples and the variety of sample environments found at the Apollo 15 site have resulted in several hypotheses that relate individual samples to local situations after even a preliminary examination of the samples. Several somewhat speculative hypotheses that relate individual samples to a geological framework are discussed in the hope that the hypotheses will provide guidelines for more detailed studies of the samples to arrive at an integrated understanding of the selenology of the Apollo 15 site. Author

N72-22821*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SOIL MECHANICS EXPERIMENT
J. K. Mitchell (Calif. Univ., Berkeley), L. G. Bromwell (MIT), W. D. Carrier, III, N. C. Costes, W. N. Houston (Calif. Univ. Berkeley), and R. F. Scott (Calif. Inst. of Technol.) *In its* Apollo 15 Prelim. Sci. Rept. 1972 28 p refs (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 22A

The Apollo 15 soil-mechanics experiment has offered greater opportunity for study of the mechanical properties of the lunar soil than previous missions, not only because of the extended lunar-surface stay time and enhanced mobility provided by the lunar roving vehicle (rover), but also because four new data sources were available for the first time. These sources were: (1) the self-recording penetrometer (SRP), (2) new, larger diameter, thin-walled core tubes, (3) the rover, and (4) the Apollo lunar-surface drill (ALSD). These data sources have provided the best bases for quantitative analyses thus far available in the Apollo Program. Author

N72-22822*# Lamont-Doherty Geological Observatory, Palisades, N.Y.
PASSIVE SEISMIC EXPERIMENT
Gary V. Latham, Maurice Ewing, Frank Press (MIT), George Sutton (Hawaii Univ.), James Dorman, Yosio Nakamura (Gen. Dyn.), Nafi Toksoz (MIT), David Lammlein, and Fred Duennebier (Hawaii Univ.) *In* NASA. Manned Spacecraft Center Apollo 15 Prelim. Sci. Rept. 1972 25 p refs (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 22A

The establishment of a network of seismic stations on the lunar surface as a result of equipment installed by Apollo 12, 14, and 15 flights is described. Four major discoveries obtained by analyzing seismic data from the network are discussed. The use of the system to detect vibrations of the lunar surface and the use of the data to determine the internal structure, physical state, and tectonic activity of the moon are examined. Author

N72-22823*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LUNAR SURFACE MAGNETOMETER EXPERIMENT
P. Dyal, C. W. Parkin, and C. P. Sonett *In its* Apollo 15 Prelim. Sci. Rept. 1972 16 p refs (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 22A

The Apollo 15 lunar-surface magnetometer (LSM) is one of a network of magnetometers that have been deployed on the moon to study intrinsic remanent magnetic fields and global magnetic response of the moon to large-scale solar and terrestrial magnetic fields. From these field measurements, properties of the lunar interior such as magnetic permeability, electrical conductivity, and temperature can be calculated. In addition, correlation with solar-wind-spectrometer data allows study of the the solar-wind plasma interaction with the moon and, in turn, investigation of the resulting absorption of gases

and accretion of an ionosphere. These physical parameters and processes determined from magnetometer measurements must be accounted for by comprehensive theories of origin and evolution of the moon and solar system. Author

N72-22824*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLAR WIND SPECTROMETER EXPERIMENT
Douglas R. Clay, Bruce E. Goldstein, Marcia Neugebauer, and Conway W. Snyder *In* NASA. Manned Spacecraft Center Apollo 15 Prelim. Sci. Rept. 1972 7 p refs (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 22A

With the deployment of the Apollo 15 lunar surface experiments package, two identical solar-wind spectrometers (SWS), separated by approximately 1100 km, are now on the lunar surface. The spectrometers provide the first opportunity to measure the properties of the solar plasma simultaneously at two locations a fixed distance apart. It is hoped that these simultaneous observations will yield new information about the plasma and its interaction with the Moon and the geomagnetic field. At the time of preparation of this report, magnetic tapes of only 20 hours of simultaneous data had been received. These data are discussed. Author

N72-22825*# Lamont-Doherty Geological Observatory, Palisades, N.Y.
HEAT FLOW EXPERIMENT
Marcus G. Langseth, Jr., Sydney P. Clark, Jr. (Yale Univ.), John L. Chute, Jr., Stephen J. Keihm, and Alfred E. Wechsler (Little (Arthur D.), Inc.) *In* NASA. Manned Spacecraft Center Apollo 15 Prelim. Sci. Rept. 1972 23 p refs (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 22A

The heat flow experiment installed on the lunar surface during the Apollo 15 flight is described. Subjects discussed are: (1) the experiment concept and design, (2) the operations of the experiment, (3) the employment of the experiment on the lunar surface at Hadley Rille site, (4) subsurface lunar temperatures, and (5) extrapolation of sensor temperatures to equilibrium values. Graphs of the data obtained from the experiment are provided. Author

N72-22826*# Rice Univ., Houston, Tex.
SUPRATHERMAL ION DETECTOR EXPERIMENT (LUNAR IONOSPHERE DETECTOR)
H. Kent Hills, Juerg C. Meister, Richard R. Vondrak, and John W. Freeman, Jr. *In* NASA. Manned Spacecraft Center Apollo 15 Prelim. Sci. Rept. 1972 10 p refs Presented at Lunar Geophys. Conf., Houston, Tex., 18-21 Oct. 1971 (See N72-22814 13-30)
(Contract NAS9-5911)
Avail: NTIS; SOD $8.00 CSCL 22A

The highly directional flow of energetic ions down the magnetosheath is described using three different look directions of the three Apollo 15 SIDE instruments. The effects of the interaction of the LM ascent-engine exhaust with the magnetosheath ions observed at the Apollo 15 site are discussed, and a preliminary analysis of the SIDE data for Apollo 12 and 14 is included. F.O.S.

N72-22827*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
COLD CATHODE GAGE EXPERIMENT (LUNAR-ATMOSPHERE DETECTOR)
F. S. Johnson (Texas Univ., Dallas), D. E. Evans (Texas Univ., Dallas), and J. M. Carroll *In its* Apollo 15 Prelim. Sci. Rept. 1972 5 p (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 22A

A preliminary evaluation of the cold cathode gage experiment which was included in the ALSEP to determine the amount of gas present on the lunar surface is reported. The instrument, electronic circuitry, and deployment are described. The preliminary results are summarized and include temperature history, and variations in gas concentration detected after deployment. F.O.S.

N72-22828*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LASER RANGING RETROREFLECTOR
J. E. Faller (Wesleyan Univ.), C. O. Alley (Maryland Univ.), P. L. Bender (Joint Inst. for Lab. Astrophys.), D. G. Currie (Maryland Univ.), R. H. Dicke (Princeton Univ.), W. M. Kaula (California Univ., Los Angeles), G. J. F. MacDonald (Council on Environ. Quality), J. D. Mulholland (Texas Univ., Austin), H. H. Plotkin, and E. C. Silverberg (Texas Univ.) *In its* Apollo 15 Prelim. Sci. Rept. 1972 6 p refs (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 22A

The lunar laser ranging retroreflector (LRRR) experiments to define the motion of the moon in its orbit are described, and the properties of the LRRR arrays and ground-station operation are discussed. It is concluded that primary benchmarks on the lunar surface are provided by the Apollo 11 and 14 arrays, and the placement of the Apollo 15 reflector. F.O.S.

N72-22829*# Bern Univ. (Switzerland).
SOLAR-WIND COMPOSITION EXPERIMENT
J. Geiss, F. Buehler, H. Cerutti, and P. Eberhardt *In* NASA. Manned Spaceflight Center Apollo 15 Prelim. Sci. Rept. 1972 7 p refs (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 22A

The Apollo program techniques for studying elemental and isotopic abundances in the solar wind are described. During Apollo 11, 12, 14 and 15 missions, aluminum foils were deployed on the lunar surface as targets for collecting solar wind ions. The foils were returned to earth, and the implanted solar wind particles were analyzed. The preliminary results showing the helium and neon concentrations are presented. F.O.S.

N72-22830*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GAMMA-RAY SPECTROMETER EXPERIMENT
James R. Arnold (Calif. Univ., San Diego), Laurence E. Peterson, Albert E. Metzger (JPL), and Jack I. Trombka *In its* Apollo 15 Prelim. Sci. Rept. 1972 6 p (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 22A

The experiments in gamma-ray spectrometry to determine the geochemical composition of the lunar surface are reported. The theory is discussed of discrete energy lines of natural radioactivity, and the lines resulting from the bombardment of the lunar surface by high energy cosmic rays. The gamma-ray spectrometer used in lunar orbit and during transearth coast is described, and a preliminary analysis of the results is presented. F.O.S.

N72-22831*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
X-RAY FLUORESCENCE EXPERIMENT
I. Adler, J. I. Trombka, J. Gerard (Natl. Acad. of Sci.), R. Schmadebeck, P. Lowman, H. Blodgett, L. Yin, E. Eller, R. Lamothe, and P. Gorenstein (Am. Sci. and Eng.) *In its* Apollo 15 Prelim. Sci. Rept. 1972 17 p refs (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 22A

The preliminary results from the Sco X-1 and Cyg X-1 obtained from the Apollo 15 X-ray detector data are presented along with preliminary results of the X-ray fluorescence spectrometric data of the lunar surface composition. The production of the characteristic X-rays following the interaction of solar X-rays with the lunar surface is described along with the X-ray spectrometer. Preliminary analyses of the astronomical X-ray observation and the X-ray fluorescence data are presented. F.O.S.

N72-22832*# American Science and Engineering, Inc., Cambridge, Mass.
ALPHA-PARTICLE SPECTROMETER EXPERIMENT
Paul Gorenstein and P. Bjorkholm *In* NASA. Manned Spacecraft Center Apollo 15 Prelim. Sci. Rept. 1972 7 p refs (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 22A

Mapping the radon emanation of the moon was studied to find potential areas of high activity by detection of radon isotopes and their daughter products. It was felt that based on observation of regions overflown by Apollo spacecraft and within the field of view of the alpha-particle spectrometer, a radon map could be constructed, identifying and locating lunar areas of outgassing. The basic theory of radon migration from natural concentrations of uranium and thorium is discussed in terms of radon decay and the production of alpha particles. The preliminary analysis of the results indicates no significant alpha emission. F.O.S.

N72-22833*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
LUNAR ORBITAL MASS SPECTROMETER EXPERIMENT
J. H. Hoffman (Texas Univ., Dallas), R. R. Hodges (Texas Univ., Dallas), and D. E. Evans *In its* Apollo 15 Prelim. Sci. Rept. 1972 7 p refs (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 22A

The experiment to measure the composition and distribution of the ambient lunar atmosphere by mass spectrometer is reported. The lunar orbital mass spectrometer is described along with the calibration procedures for the instrument. Preliminary results indicate that a large number of gas molecules were observed in the vicinity of the spacecraft in lunar orbit. Many of these molecules are considered to be of spacecraft origin. F.O.S.

N72-22834*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
S-BAND TRANSPONDER EXPERIMENT
W. L. Sjogren (JPL), P. Gottlieb (JPL), P. M. Muller (JPL), and W. R. Wollenhaupt *In its* Apollo 15 Prelim. Sci. Rept. 1972 6 p refs (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 22A

The experiment which derives data from three lunar-orbiting objects, the command-service module (CSM), the lunar module (LM), and the subsatellite in the S-band is described. Each provides detailed information on the near-side lunar gravitational field. The primary emphasis is on the low-altitude (20 km) CSM data. The LM data cover a very short time span and are somewhat redundant with the CSM data. The resolution of the high-altitude (100 km) CSM data is not as great as that of the low altitude data. The low-altitude CSM and LM data coverage and the complementary coverage obtained during the Apollo 14 mission are presented. The experiment uses the same technique of gravity determination employed on the Lunar Orbiter, in the data of which the large anomalies called mascons were first observed. The data consist of variations in the spacecraft speed as measured by the Earth-based radio tracking system. Author

N72-22835*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SUBSATELLITE MEASUREMENTS OF PLASMAS AND SOLAR PARTICLES
K. A. Anderson (California Univ., Berkeley), L. M. Chase (California Univ., Berkeley), R. P. Lin (California Univ., Berkeley), J. E. McCoy, and R. E. McGuire (California Univ., Berkeley) *In its* Apollo 15 Prelim. Sci. Rept. 1972 14 p refs (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 22A

The experiment with the small scientific subsatellite which was launched into lunar orbit from Apollo 15 is described. The subsatellite was designed to measure plasma and energetic-particle fluxes, vector magnetic fields, and velocity of the subsatellite for determining lunar gravitational anomalies. The theory of particle-shadow formation by the moon solar wind electrons, and energetic-electron fluxes in interplanetary space are discussed along with an analysis of the initial data. F.O.S.

N72-22836*# California Univ., Los Angeles.
THE PARTICLES AND FIELDS SUBSATELLITE MAGNETOMETER EXPERIMENT
Paul J. Coleman, Jr., G. Schubert, C. T. Russell, and L. R. Sharp *In* NASA. Manned Spaceflight Center Apollo 15 Prelim. Sci. Rept. 1972 9 p refs (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 22A

A preliminary analysis of magnetometer data from Apollo 15 subsatellite is concluded. Remnant magnetization is a characteristic property of the moon, and the distribution is such that a complex pattern is produced. A mapping of the distribution is feasible with the present experiment. Lunar induction fields produced by transients in interplanetary magnetic field are detectable at satellite orbit. Magnetometer data will provide estimates of the latitude and longitude dependences of interior conductivity. The plasma void extends to some altitude below the satellite orbit and probably the lunar surface. Solar wind near the limbs is usually strongly disturbed. Author

N72-22837*# Stanford Univ., Calif.
BISTATIC-RADAR INVESTIGATION
H. T. Howard and G. L. Tyler *In* NASA. Manned Spacecraft Center Apollo 15 Prelim. Sci. Rept. 1972 10 p refs (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 22A

A bistatic-radar study during the Apollo 15 flight is reviewed, with the orbiting command module as one terminal. Bistatic-radar slopes are compared to geological maps of Copernicus and Riphaeus mountain regions and Kepler region. Basic theory is discussed, including the radar echoes composed of the sum of the reflections from the moon area that is mutually visible from the spacecraft and earth. A signal receiving system and data processing system are outlined schematically. J.A.M.

N72-22838*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO WINDOW METEOROID EXPERIMENT
Burton G. Cour-Palais, Robert E. Flaherty, and Milton L. Brown (Lockheed Electron.) *In its* Apollo 15 Prelim. Sci. Rept. 1972 9 p refs (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 22A

Apollo window meteoroid experiment for obtaining data from crater counts and analysis of meteoroid residue combined with fused glass in described. A preliminary estimate of the flux resulting from seven Apollo spacecraft is found to be in agreement with the Surveyor 3 data, but is lower than the model environment. Author

N72-22839*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
VISUAL OBSERVATIONS FROM LUNAR ORBIT, PART A
Farouk El-Baz (Bellcomm, Inc.) and Alfred M. Worden *In its* Apollo 15 Prelim. Sci. Rept. 1972 26 p refs (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 22A

Visual observations from Apollo 15 lunar orbits are discussed, complementing photographic and other remotely sensed data. Color tone of surface units, global tectonic trends, and small scale features are considered. Visual observations were made on Tsiolkovsky Crater, swirls in Mare Marginis, Picard Crater region, Proclus Crater, Littrow Crater area, landing site area, flow fronts in Mare Imbrium, and Aristarchus Plateau. J.A.M.

N72-22840*# Geological Survey, Washington, D.C.
PHOTOGRAMMETRIC ANALYSIS OF APOLLO 15 RECORDS, PART B

Frederick J. Doyle *In* NASA. Manned Spacecraft Center Apollo 15 Prelim. Sci. Rept. 1972 9 p (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 22A

The three cameras (stellar, mapping, and panoramic) together with the laser altimeter are included in the scientific instrument module bay, representing an integrated photogrammetric system. Data analysis objectives and procedure are presented, along with deformation of second generation negatives and heighting accuracy of panoramic photographs. Mapping camera photographs and stellar photography are evaluated. Rectified prints from panoramic camera photographs are produced, as well as enlarged prints from the mapping camera pictures. J.A.M.

N72-22841*# Geological Survey, Washington, D.C.
PHOTOGRAMMETRY OF APOLLO 15 PHOTOGRAPHY, PART C
Sherman S. C. Wu, Francis J. Schafer, Raymond Jordan, Gary M. Nakata, and James L. Derick *In* NASA. Manned Spacecraft Center Apollo 15 Prelim. Sci. Rept. 1972 12 p (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 22A

In the Apollo 15 mission, a mapping camera system and a 61 cm optical bar, high resolution panoramic camera, as well as a laser altimeter were used. The panoramic camera is described, having several distortion sources, such as cylindrical shape of the negative film surface, the scanning action of the lens, the image motion compensator, and the spacecraft motion. Film products were processed on a specifically designed analytical plotter.
J.A.M.

N72-22842*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APOLLO 15 LASER ALTIMETER, PART D **c14**
F. L. Robertson and W. M. Kaula (Calif. Univ., Los Angeles) *In* NASA. Manned Spacecraft Center Apollo 15 Prelim. Sci. Rept. 1972 2 p ref (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 20E

The laser altimeter, consisting of a Q-switched ruby laser, transmitting optics, counting timer, receiving optics, and a photomultiplier is described. Harmonic analysis of the mission data is also presented. J.A.M.

N72-22843*# Bellcomm, Inc., Washington, D.C.
SURFACE DISTURBANCES AT THE APOLLO 15 LANDING SITE, PART E **c13**
N. W. Hinners and Farouk El-Baz *In* NASA. Manned Spacecraft Center Apollo 15 Prelim. Sci. Rept. 1972 3 p (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 80K

High resolution panoramic photographs taken from 110 km orbits of the command service module show the lunar module structure on the moon as evidenced by reflected light and by the shadow. Before and after photographs of the landing site are presented; the increased brightness or halo is attributed to mare surface materials. J.A.M.

N72-22844*# Geological Survey, Washington, D.C.
REGIONAL GEOLOGY OF HADLEY RILLE, PART F **c13**
Keith A. Howard and James W. Head (Bellcomm, Inc.) *In* NASA. Manned Spacecraft Center Apollo 15 Prelim. Sci. Rept. 1972 5 p (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 08G

Local geology of Hadley Rille near the landing site of Apollo 15 is described. Orbital photography from the Hasselbad, metric, and panoramic cameras is used to study regional relationships of the rille. The shape of the rille due to various natural causes is examined, along with stratographic measurements of mare materials. J.A.M.

N72-22845*# Geological Survey, Washington, D.C.
LINEAMENTS THAT ARE ARTIFACTS OF LIGHTING, PART G
Keith A. Howard and Bradley R. Larsen *In* NASA. Manned Spacecraft Center Apollo 15 Prelim. Sci. Rept. 1972 5 p (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 22A

Apollo 15 orbital photographs, particularly those taken at low sun elevation angles, are examined revealing grid patterns of lineaments. Preliminary results of experiments demonstrate that spurious lineaments and grid patterns can be produced and that the directions are dependent in part upon the position of the light source. The experiments were designed to duplicate the effect of bright sunlight reflecting from a hummocky surface with little or no diffuse light in the shadowed areas. J.A.M.

N72-22846*# Geological Survey, Washington, D.C.
SKETCH MAP OF THE REGION AROUND CANDIDATE LITTROW APOLLO LANDING SITES, PART H
M. H. Carr *In* NASA. Manned Spacecraft Center Apollo 15 Prelim. Sci. Rept. 1972 3 p (See N72-22814 13-30)
Avail: NTIS CSCL 22A

Photographs and geologic maps of the area around Littrow rilles and eastern edge of Mare Serenitatis are presented, along with variations in the features and compositions of the region.
J.A.M.

N72-22847*# Bellcomm, Inc., Washington, D.C.
THE CINDER FIELD OF THE TAURUS MOUNTAINS, PART I
Farouk El-Baz *In* NASA. Manned Spacecraft Center Apollo 15 Prelim. Sci. Rept. 1972 6 p refs (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 22A

A dark-colored mare unit within the southwestern corner of the Taurus Mountains is discussed. The geologic characteristics of this unit, the intricate relationship between it and the surrounding features, and the probable source of the unit were the objects of visual observations during the Apollo 15 flight. The results of these observations made from orbit indicate that the unit probably consists of volcanic ash or pyroclastic deposits that came to the surface through a multitude of cinder cones. The local setting of the area and the relationship of the dark deposit to other nearby geologic units are examined in light of data obtained from the Apollo 15 panoramic camera photographs. D.L.G.

N72-22848*# Geological Survey, Washington, D.C.
PRELIMINARY GEOLOGIC MAP OF THE REGION AROUND THE CANDIDATE PROCLUS APOLLO LANDING SITE, PART J **c13**
Don E. Wilhelms *In* NASA. Manned Spacecraft Center Apollo 15 Prelim. Sci. Rept. 1972 4 p (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 08G

The Proclus Crater region was mapped to test the value, for photogeologic mapping purposes, of Apollo 15 metric photographs and to estimate the scientific value of the area as a potential landing site. Adjacent frames of the metric photography were overlapped with the base frame to provide stereographic images. Because of the high quality of the photographs, it was found that the geologic units could be more definitely interpreted and dated than those of earlier maps. The photographs tend to confirm the earlier interpretation of the rugged area as composed of bedrock uplifted when the Crisium basin formed. They also suggest that an earlier predominantly volcanic interpretation of the terra in this area might be replaced by an interpretation in which mass wasting and fracturing play the major roles in producing different terrain types. It was concluded that because of apparent lithologic homogeneity, the terra of the Proclus region is an undesirable objective for an extensive manned lunar landing mission. D.L.G.

N72-22849*# Geological Survey, Washington, D.C.
GEOLOGIC SKETCH MAP OF THE CANDIDATE PROCLUS APOLLO LANDING SITE, PART K
Baerbel Koesters Lucchitta *In* NASA. Manned Spacecraft

Center Apollo 15 Prelim. Sci. Rept. 1972 5 p (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 03B

An Apollo 15 panoramic camera frame was used as a base for a geologic sketch map of an area near Proclus Crater. The map was prepared to investigate the usefulness of the panoramic camera photography in large-scale geologic mapping and to assess the geologic value of the area as a potential Apollo landing site. The photographs, taken under high solar illumination, resulted in good definition of albedo features, and stereoscopic viewing provided extreme clarity of topographic relief with terrain units easily delineated. The geological characteristics of the area as evidenced by the high-resolution photographs is discussed. It is concluded that the panoramic camera photographs reveal a wealth of detail and are eminently suited for geologic mapping purposes. In addition, the Proclus area, as a potential landing site, offers relatively rough plains terrain. D.L.G.

N72-22850*# Geological Survey, Washington, D.C.
SELECTED VOLCANIC FEATURES, PART L
Mareta N. West *In* NASA. Manned Spacecraft Center Apollo 15 Prelim. Sci. Rept. 1972 2 p (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 03B

Volcanic features obtained from a preliminary examination of Apollo 15 orbital photographs are described. Of particular interest are the features photographed in the vicinity of the far-side crater basin Tsiolkovsky. The photographs indicate that smooth, plains-forming material is present in parts of the ejecta blanket southeast of the basin rim. A debris flow on the northwestern part of the rim is also depicted. The usefulness of near-terminator photography is evidenced by the fact that numerous flow fronts not seen in photographs taken at higher angles of illumination are clearly visible. It is concluded that the presence of so many fronts confirms the belief that multiple flows are responsible for the filling of lunar mare basins. D.L.G.

N72-22851*# Arizona Univ., Tucson. Lunar and Planetary Lab.
MARE IMBRIUM LAVA FLOWS AND THEIR RELATIONSHIP TO COLOR BOUNDARIES, PART M
Ewen A. Whitaker *In* NASA. Manned Spacecraft Center Apollo 15 Prelim. Sci. Rept. 1972 2 p (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 08G

The Apollo 15 metric camera photography provided a number of spectacular views of most of the southern and central portions of the unique systems of major lava flows that stretch diagonally across Mare Imbrium from the general area of Euler Crater to a point east of Le Verrier Crater. A preliminary examination of the photographs indicates that the source of the material comprising the major flows is situated to the west of Euler Crater and south of the limits of the photographic coverage. The photographs also show clearly that most, if not all, the mare ridges included were formed after the solidification of the flows. Few color boundaries exist in the area of metric photography where the illumination angle is low enough to show the fronts of some of the very thin flows. However, patches of redder material lying northeast of Mt. Lahire are found to be enclosed by low flow fronts, confirming the theory that the redder material represents an earlier filling of the Imbrium basin. D.L.G.

N72-22852*# Arizona Univ., Tucson. Lunar and Planetary Lab.
AN UNUSUAL MARE FEATURE, PART N
Ewen A. Whitaker *In* NASA. Manned Spacecraft Center Apollo 15 Prelim. Sci. Rept. 1972 2 p (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 03B

During rapid scanning of the Apollo 15 panoramic camera photography, a peculiar feature was noted in a small patch of mare material lying between the Haemus and the Apennine Mountains. The patch is abnormal in that it is an unbordered plateau with the surface appearing to lie several hundred meters above adjacent mare patches. Significant characteristics of the feature are discussed and two panoramic camera photographs are illustrated. D.L.G.

N72-22853*# Geological Survey, Washington, D.C.
REGIONAL VARIATIONS IN THE MAGNITUDE OF HEILIGENSCHEIN AND CAUSAL CONNECTIONS, PART O
Robert L. Wildey *In* NASA. Manned Spacecraft Center Apollo 15 Prelim. Sci. Rept. 1972 1 p (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 03B

A preliminary quantitative analysis was conducted of four frames exposed by the Apollo 15 metric camera. Two of the frames show the zero-phase surge on maria and the other two show the surge on terrae. It was found that the curves resulting from brightness plotted as a function of phase angle, differ markedly according to which terrain type is involved. The magnitude of the heiligenschein was found to be significantly greater for the maria than for the terrae. D.L.G.

N72-22854*# Geological Survey, Washington, D.C.
THE PROCESS OF CRATER REMOVAL IN THE LUNAR MARIA, PART P
L. A. Soderblom *In* NASA. Manned Spacecraft Center Apollo 15 Prelim. Sci. Rept. 1972 5 p (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 03B

Near-terminator photography from the Apollo 14 and 15 missions is used as a basis to evaluate the processes by which craters disappear from the lunar surface. From observations and analyses it is concluded that: (1) The erosion of lunar craters in the size range of 10 m to 1 km is effected principally by small impacts producing minute changes in crater form up to the point where the crater is worn to an interior slope of approximately 1 degree. Below that slope, the annihilation process is dominated by the formation of younger overlapping craters. (2) The distribution of shapes of craters in this size range can be explained as resulting from impact generated processes. D.L.G.

N72-22855*# Bellcomm, Inc., Washington, D.C.
CRATER SHADOWING EFFECTS AT LOW SUN ANGLES, PART Q
H. J. Moore *In* NASA. Manned Spacecraft Center Apollo 15 Prelim. Sci. Rept. 1972 3 p (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 03B

A comparison of Apollo 15 lunar surface photographs taken at low sun-elevation angles with photographs of an experimentally cratered surface at low lighting angles is discussed. The comparison revealed marked similarities, the most significant being that the smallest craters in both sets of photographs are filled with shadows that form beadlike chains and clusters. It was also found that the fraction of area covered by shadows within the smaller craters is so large that 30 to 40 percent of the total field of view is covered by shadow. It is concluded that: the fraction of area covered by resolvable craters, which should be somewhat less than the fraction of area covered by shadow for photographs with very low sun elevation angles, may be calculated using the steady state crater frequency distribution for craters from 20 to 100 m in diameter and then adding the area covered by larger craters for which the crater frequency distribution has the form of the crater-production frequency distribution. D.L.G.

N72-22856*# Bellcomm, Inc., Washington, D.C. **c14**
NEAR-TERMINATOR PHOTOGRAPHY, PART R
J. W. Head and D. D. Lloyd *In* NASA. Manned Spacecraft Center Apollo 15 Prelim. Sci. Rept. 1972 6 p (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 14E

The advantages resulting from the use of near-terminator photography in lunar surface investigations are discussed. It is pointed out that, under near-terminator conditions, small changes in slope produce greater contrast changes than at high sun elevation angles. This desirable phenomenon is confirmed by an examination of the near-terminator photography taken during the Apollo 15 mission. Many of the photographs obtained show lunar surface areas within a few degrees of the terminator and are therefore of significant geologic interest. In addition, many geologic features stand out in a distinct manner not normal in

conventional lunar photography, thus providing additional data on the surface morphology and the configuration of a large number of lunar surface structures. D.L.G.

N72-22857*# Bellcomm, Inc., Washington, D.C.
FIRST EARTHSHINE PHOTOGRAPHY FROM LUNAR ORBIT, PART S c14
D. D. Lloyd and J. W. Head *In* NASA. Manned Spacecraft Center Apollo 15 Prelim. Sci. Rept. 1972 7 p (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 14E

The first photographs of the moon taken with earthshine illumination by the Apollo 15 crew were examined. Emphasis in the analysis was placed on a comparison of predicted exposures and obtained exposures. The results of the investigation indicate the following: (1) The predicted exposure of the maria areas and the obtained exposures were in reasonably close agreement. (2) The apparent-albedo values obtained for the floor of Aristarchus Crater are seven times greater than those for the maria. D.L.G.

N72-22858*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ASTRONOMICAL PHOTOGRAPHY, PART T c14
L. Dunkelman, R. D. Mercer (Dudley Obs.), C. L. Ross (High Altitude Obs.), and A. M. Worden *In its* Apollo 15 Prelim. Sci. Rept. 1972 39 p refs (See N72-22814 13-30)
Avail: NTIS; SOD $8.00 CSCL 14E

Photographic observations of astronomical interest conducted during the Apollo 15 mission are discussed. Procedures used in photographing the solar corona are described together with calibration and reduction methods. In addition, selected preliminary results obtained from the photography are presented. D.L.G.

N72-22859*# Bellcomm, Inc., Washington, D.C.
AN EMPIRICAL METHOD FOR DETERMINING THE LUNAR GRAVITY FIELD Ph.D. Thesis - George Washington Univ.
Alfred John Ferrari Sep. 1971 158 p refs
(Contract NASw-417)
(NASA-CR-126149; TM-2014-1) Avail: NTIS CSCL 03B

A method has been devised to determine the spherical harmonic coefficients of the lunar gravity field. This method consists of a two-step data reduction and estimation process. In the first step, a weighted least-squares empirical orbit determination scheme is applied to Doppler tracking data from lunar orbits to estimate long-period Kepler elements and rates. Each of the Kepler elements is represented by an independent function of time. The long-period perturbing effects of the earth, sun, and solar radiation are explicitly modeled in this scheme. Kepler element variations estimated by this empirical processor are ascribed to the non-central lunar gravitation features. Doppler data are reduced in this manner for as many orbits as are available. In the second step, the Kepler element rates are used as input to a second least-squares processor that estimates lunar gravity coefficients using the long-period Lagrange perturbation equations. Author

N72-22860*# Cornell Univ., Ithaca, N.Y.
STUDY AND INTERPRETATION OF LUNAR CLOSE-UP STEREO PHOTOGRAPHY Final Report
Thomas Gold Aug. 1971 12 p
(Contract NAS9-10657)
(NASA-CR-115500; CRSR-458) Avail: NTIS CSCL 03B

The lunar close-up steroscopic camera was used successfully on Apollo 11, 12, and 14 flights. It functioned without any technical faults and was judged convenient to use by all three crews. It recorded a variety of surface textures in the lunar soil, both disturbed and undisturbed, a number of rock surfaces in the undisturbed condition, and a number of surface samples of materials brought to the moon whose interaction with the lunar soil was to be tested. A resolution of approximately 80 microns was aimed for in the design of the camera and was indeed obtained on all pictures. Stereoscopy played a major part in interpreting surface textures and small scale structure. Author

N72-22861# Lowell Observatory, Flagstaff, Ariz.
THE G NUMBERED STARS: 8991 STARS FAINTER THAN MAGNITUDE 8 WITH MOTIONS GREATER THAN 0.26 SECONDS/YEAR
H. L. Giclas, R. Burnham, Jr., and N. G. Thomas 23 Feb. 1971 175 p refs Sponsored by NSF
Avail: NTIS

A summary of the Lowell Proper Motion Survey for the Northern Hemisphere is presented. About 9,000 stars with observed positions, proper motions, magnitudes, and colors are listed. The catalog was prepared from previously published Lowell Bulletins over a period of the last 13 years. In order to make the material more accessible and useful, duplicate observations have been combined, and all entries have been ordered in right ascension and cross-indexed by G number. Author

N72-22862# Royal Greenwich Observatory, Herstmonceux (England).
GREENWICH TIME REPORT, JANUARY - MARCH 1971
Mar. 1971 24 p
Avail: NTIS

Time and latitude observations, radio time signals, standard frequency emission, loran C measurements, and cesium standard data are tabulated. Variations in the earth's rotation rate, difficulties in interpreting interference data, and loran C receiver delays are briefly described. N.E.N.

N72-22863*# National Aeronautics and Space Administration, Washington, D.C.
THE TOR-1 APPARATUS FOR INVESTIGATING LUNAR GROUND
Ye. A. Dukhovskoy, A. A. Silin, and V. V. Shvarev Apr. 1972 9 p ref Transl. into ENGLISH from Priroda (USSR), no. 1, Jan. 1972 p 83-86
(NASA-TT-F-14239) Avail: NTIS CSCL 03B

The design and operation are discussed of an apparatus for studying lunar soil samples. Results of tests of engineering and physical properties are presented. K.P.D.

N72-22864*# National Aeronautics and Space Administration, Washington, D.C.
DESCENT INTO PLANETARY ATMOSPHERES
A. Miranov Apr. 1972 9 p Transl. into ENGLISH from Aviats. i Kosmonavt. (Moscow), no. 1, 1972 p 36-37, and 39
(NASA-TT-F-14229) Avail: NTIS CSCL 22C

Problems involved in planning a soft landing descent through the dense Venus atmosphere and the rarefied Mars atmosphere are reviewed. Characteristics are given for direct and orbital descent programs, aerodynamic braking, ablative shielding, and tradeoffs between weight and velocity considerations. N.E.N.

N72-22865*# National Aeronautics and Space Administration, Washington, D.C.
THE 322 DAYS IN THE SEA OF RAINS
A. Bessonov Apr. 1972 9 p Transl. into ENGLISH from Aviat. Kosmonaut. (USSR), no. 1, Jan. 1972 p 33-35
(NASA-TT-F-14231) Avail: NTIS CSCL 03B

The operation and accomplishments of the Lunokhod 1 lunar rover vehicle are discussed. The lunar rover operated for a period of ten and a half months in the lunar geographical area called the Sea of Rains. The communications contacts, instrument operation, data acquisition, data transmission, and the objectives of the scientific program are described. Samples of some of the data obtained during the operation of Lunokhod 1 are included. Author

N72-22866*# National Aeronautics and Space Administration, Washington, D.C.
LUNAR DEVELOPMENT IN THE LIGHT OF MODERN

DATA
B. Yu. Levin Apr. 1972 19 p refs Transl. into ENGLISH from Priroda (USSR), no. 12, Dec. 1972 P 3-9
(NASA-TT-F-14238) Avail: NTIS CSCL 03B

Results of lunar investigations and analyses of lunar samples has led to a revision of the thermal history of the moon and subsurface magmatic differentiation. Heating early in the moon's evolution is considered and various possible causes are mentioned. Volcanic activity and differentiation in the lunar interior are also discussed. K.P.D.

N72-22867# Accademia Nazionale dei Lincei, Rome (Italy).
ACTUAL PROBLEMS OF SCIENCE AND CULTURE: ACTUAL ASPECTS OF COSMOLOGY
Livio Gratton 1971 16 p refs In ITALIAN Conf. Held 20 Feb. 1971
(Rept-156) Avail: NTIS

The characteristics of cosmology are discussed. Topics presented include: expansion of the universe and its significance, cosmological principals and time and predictions of the actual state of the universe. Transl. by F.O.S.

N72-22868# Chalmers Univ. of Technology, Goteborg (Sweden). School of Electrical Engineering.
RADIOASTRONOMICAL STUDIES OF HYDROGEN AND HYDROXYL SPECTRAL LINES Ph.D. Thesis
Anders Winnberg May 1970 74 p refs
(TR-3) Avail: NTIS

The 21-cm hydrogen and 18-cm hydroxyl lines in stellar and galactic spectra are considered. Four papers are presented on the upper limit to velocity dispersion of galactic hydrogen clouds from 21-cm observations in Perseus, structure of galactic neutral hydrogen in a region of Cygnus, OH radio emission sources in Cygnus, and 18-cm OH emission in the Cepheus IV association. K.P.D.

N72-22869# Rome Univ. (Italy). Inst. of Physics.
ON ROTATING REFERENCE SYSTEMS IN EINSTEIN'S THEORY OF GRAVITATION
L. Pietronero 29 Sep. 1971 11 p refs
(Nota-Interna-337) Avail: NTIS

Solutions to the equations of motion of a mass point, solving (in Einstein's linear approximation) for the gravitational field created by a rotating shell, in order to determine if the centrifugal and coriolis forces are relativistic in rotating systems of reference, are reviewed. The conditions of relativity of rotation are discussed. ESRO

N72-22870# Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia). Div. of Building Research.
SOLAR POSITION AND RADIATION TABLES FOR BRISBANE (LATITUDE 27.5 DEGREES S)
J. W. Spencer 1971 76 p refs
(PB-204593; Tech-Paper-28) Avail: NTIS CSCL 04A

Tables of solar position and radiation received from a clear sky are presented, giving computed values of these variables at Brisbane as functions of clock time for various attitudes of surface. Tables are also given of sunrise and sunset times, and of Sun arrival and departure times for vertical surfaces. Author (GRA)

N72-22871# Arizona Univ., Tucson. Lunar and Planetary Lab.
SUPPORT OF AFCRL LUNAR LASER FIELD UNIT Final Scientific Report, 25 Mar. 1969 - 24 Jun. 1971
Gerard P. Kuiper 24 Jul. 1971 61 p refs
(Contract F19628-69-C-0227; AF Proj. 8607)
(AD-735298; AFCRL-71-0469) Avail: NTIS CSCL 03/1

The procedures described are used in the construction and development of a 60-inch aperture lunar laser telescope at low cost. These procedures were based on a previous development at this Laboratory of inexpensive photometric telescopes of 60-inch aperture. The adaptation of these techniques to the more severe requirements of a lunar laser telescope has presented difficult problems. In addition, a modified telescope mounting had to be constructed, a special guider, and a dome with associated living quarters located on Mt. Lemmon, elev. 9160 ft. Author (GRA)

N72-22872# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
GENERALIZED EQUATIONS FOR THE POSITION AND ATTITUDE OF A MULTIPLY CONNECTED SPACECRAFT. 1: THE DYNAMICAL EQUATIONS
D. K. Anand and J. M. Whisnant Apr. 1971 51 p ref
(Contract N00017-62-C-0604)
(AD-736151; APL-TG-1163-1) Avail: NTIS CSCL 22/3

The nonlinear differential equations for the rotational motion of an earth-orbiting spacecraft are derived in terms of Newtonian mechanics and are put in a form suitable for computer solution. The spacecraft is assumed to have a general configuration consisting of a main body and any number of secondary bodies each of which is gimbaled to the main body. The equations describing the attitude motion of the main body are in terms of a set of Euler angles that relate the orientation of a reference frame fixed in the spacecraft to a reference frame whose orientation can be specified as an arbitrary function of time in inertial space. Properties of general Euler angle rotation matrices and the equations for the Keplerian orbit are contained in the Appendix. Author (GRA)

N72-22873# Aerospace Corp., El Segundo, Calif. Lab. Operations.
INFRARED STARS: CHARACTERISTICS OF OH EMISSION Technical Report, Aug. 1969 - Aug. 1971
William J. Wilson and Alan H. Barrett (MIT) 30 Nov. 1971 74 p refs
(Contract F04701-71-C-0172; Grant NSF GB-20769)
(AD-735673; TR-0172(2230-20)-10; SAMSO-TR-71-323) Avail: NTIS CSCL 03/2

The characteristics of OH emission sources associated with late M-type variable stars are discussed. A total of 456 IR stars and 18 other objects were surveyed and OH emission was detected from 25 IR stars. Including four OH sources discovered by other observers, there are 29 OH emission sources associated with IR stars. In addition there are 8 OH sources which have OH emission characteristics similar to the OH/IR stars but for which no IR star has yet been detected. Based on their OH, IR and visual properties, the OH/IR stars can be divided into three groups. The group of OH/IR stars (19 stars) with their OH emission strongest at 1612 MHz and concentrated in two narrow velocity ranges is discussed in this paper. Author (GRA)

N72-22402# Consiglio Nazionale delle Ricerche, Rome (Italy). Ist. Nazionale di Ricerche Spaziali.
PLANS FOR AN ITALIAN GEOSTATIONARY SATELLITE
B. Ratti *In* ESRO The ESRO Geostationary Magnetospheric Satellite Mar. 1971 p 281-284 (See N72-22377 13-13)
Avail: NTIS

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N72-22874* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DEPLOYABLE SOLAR CELL ARRAY Patent
Herman P. Valentijn, inventor (to NASA) Issued 16 Nov. 1971

14 p Filed 8 Apr. 1970 Supersedes N70-42330 (08 - 24, p 4608) Sponsored by NASA
(NASA-Case-NPO-10883; US-Patent-3,620,846; US-Patent-Appl-SN-26573; US-Patent-Class-136-89; US-Patent-Class-312-257) Avail: US Patent Office CSCL 13M

A depolyable support particularly suited for use in operatively supporting solar cell arrays aboard spacecraft is described. It is characterized by independent modules, each including a panel formed of trapezoidal panel segments and articulated track segments. These are adapted to be stowed in a folded configuration and subsequently deployed into a laterally extended and substantially continuous surface circumscribing the spacecraft for positioning the arrays. A cantilever structure accommodates deployment of the solar cell panels in a continuous harmonic sequence for substantially eliminating the transient loading of the spacecraft during panel deployment.

Official Gazette of the U.S. Patent Office

N72-22875*+ National Aeronautics and Space Administration, Washington, D.C.
REFERENCE EARTH ORBITAL RESEARCH AND APPLICATIONS INVESTIGATIONS (BLUE BOOK). VOLUME 1: SUMMARY
15 Jan. 1971 80 p
(NHB-7150.1-Vol-1) Avail: NTIS; SOD $0.70 CSCL 22A

The criteria, guidelines, and an organized approach for use in the space station and space shuttle program definition phase are presented. Subjects discussed are: (1) background information and evolution of the studies, (2) definition of terms used, (3) concepts of the space shuttle, space station, experiment modules, shuttle-sortie operations and modular space station, and (4) summary of functional program element (FPE) requirements. Diagrams of the various configurations and the experimental equipment to be installed in the structures are included. Author

N72-22876*+ National Aeronautics and Space Administration, Washington, D.C.
REFERENCE EARTH ORBITAL RESEARCH AND APPLICATIONS INVESTIGATIONS (BLUE BOOK). VOLUME 2: ASTRONOMY
15 Jan. 1971 298 p refs
(NHB-7150.1-Vol-2) Avail: NTIS; SOD $2.50 CSCL 03A

Representative astronomy objectives, experiments, facilities, and instruments for use in the space station are discussed. The specific program elements describe a coordinated multiwavelength, multisensor approach needed to locate, observe, and interpret radiation from extragalactic, galactic, solar, and planetary sources in the different parts of the spectrum with spectral, angular, and temporal resolution not achievable from earth sites. Items of astronomy equipment are identified for the experiments to be conducted. Author

N72-22877*+ National Aeronautics and Space Administration, Washington, D.C.
REFERENCE EARTH ORBITAL RESEARCH AND APPLICATIONS INVESTIGATIONS (BLUE BOOK). VOLUME 3: PHYSICS
15 Jan. 1971 208 p refs
(NHB-7150.1-Vol-3) Avail: NTIS; SOD $1.75 CSCL 14B

The definition of physics experiments to be conducted aboard the space station is presented. The four functional program elements are: (1) space physics research laboratory, (2) plasma physics and environmental perturbation laboratory, (3) cosmic ray physics laboratory, and (4) physics and chemistry laboratory. The experiments to be conducted by each facility are defined and the crew member requirements to accomplish the experiments are presented. Author

N72-22878*+ National Aeronautics and Space Administration, Washington, D.C.
REFERENCE EARTH ORBITAL RESEARCH AND APPLICATIONS INVESTIGATIONS (BLUE BOOK). VOLUME 4: EARTH OBSERVATIONS
15 Jan. 1971 82 p refs
(NHB-7150.1-Vol-4) Avail: NTIS; SOD $0.75 CSCL 08G

The earth observations capability of the space station and space shuttle program definition is discussed. The stress in the functional program element has been to update the sensor specifications and to shift some of the emphasis from sensors to experiments to be done aboard the facility. The earth observations facility will include provisions for data acquisition, sensor control and display, data analysis, and maintenance and repair. The facility is research and development in nature with a potential for operational applications. Author

N72-22879*+ National Aeronautics and Space Administration, Washington, D.C.
REFERENCE EARTH ORBITAL RESEARCH AND APPLICATIONS INVESTIGATIONS (BLUE BOOK). VOLUME 5: COMMUNICATIONS/NAVIGATION
15 Jan. 1971 72 p refs
(NHB-7150.1-Vol-5) Avail: NTIS; SOD $0.65 CSCL 17G

The design and development of a communications/navigation facility for operation aboard space stations and space shuttles are discussed. The objectives of the facility are as follows: (1) to develop and demonstrate satellite and spacecraft technology applicable to space communications, navigation, and traffic control, (2) to optimize the use of the electromagnetic spectrum for communications and navigation satellite systems, and (3) to provide fundamental understanding of the space communications and navigation sciences to permit application of this discipline to government and industry. Author

N72-22880*+ National Aeronautics and Space Administration, Washington, D.C.
REFERENCE EARTH ORBITAL RESEARCH AND APPLICATIONS INVESTIGATIONS (BLUE BOOK). VOLUME 6: MATERIALS SCIENCES AND MANUFACTURING
15 Jan. 1971 102 p refs
(NHB-7150.1-Vol-6) Avail: NTIS; SOD $1.25 CSCL 22A

The development of commercial manufacturing and research activities in space is discussed. The capability is to be installed in space stations in order to exploit the extended free fall which makes many novel manipulations of materials possible and alters the behavior of certain chemical and physical processes. The broad objectives are: (1) to develop technical basis required for commercial use of manned space facilities, (2) to provide indirect economic benefits by exploiting advantages of space laboratory facilities to solve critical experimental problems, and (3) to initiate manufacturing operations in space by private enterprise for commercial purposes and by agencies of the Government for public purposes. Author

N72-22881*+ National Aeronautics and Space Administration, Washington, D.C.
REFERENCE EARTH ORBITAL RESEARCH AND APPLICATIONS INVESTIGATIONS (BLUE BOOK). VOLUME 7: TECHNOLOGY
15 Jan. 1971 211 p refs
(NHB-7150.1-Vol-7) Avail: NTIS; SOD $1.75 CSCL 22B

The candidate experiment program for manned space stations with specific application to technology disciplines is presented. The five functional program elements are devoted to the development of new technology for application to future generation spacecraft and experiments. The functional program elements are as follows: (1) monitor and trace movement of external contaminants to determine methods for controlling contamination, (2) analysis of fundamentals of fluid systems management, (3) extravehicular activity, (4) advanced spacecraft systems tests, and (5) development of teleoperator system for use with space activities. Author

N72-22882*+ National Aeronautics and Space Administration, Washington, D.C.
REFERENCE EARTH ORBITAL RESEARCH AND APPLICA-

TIONS INVESTIGATIONS (BLUE BOOK). VOLUME 8: LIFE SCIENCES
15 Jan. 1971 319 p refs
(NHB-7150.1-Vol-8) Avail: NTIS; SOD $2.75 CSCL 06B

The functional program element for the life sciences facilities to operate aboard manned space stations is presented. The life sciences investigations will consist of the following subjects: (1) medical research, (2) vertebrate research, (3) plant research, (4) cells and tissue research, (5) invertebrate research, (6) life support and protection, and (7) man-system integration. The equipment required to provide the desired functional capability for the research facilities is defined. The goals and objectives of each research facility are described. Author

N72-22883*# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
TRANSONIC WIND TUNNEL TESTS OF A .015 SCALE SPACE SHUTTLE BOOSTER MODEL
R. J. Dennis Jan. 1972 253 p refs
(Contract NAS8-26701)
(NASA-CR-123603; CAL-AA-4018-W-7) Avail: NTIS CSCL 22B

Details of the test program, an outline of the test procedure, and results of the investigation in tabular form are presented. The base drag reduction potential was determined at cruise conditions (M = .40) of a modified base region, with and without base bleed flow. Transonic effects and cruise control effectiveness of the new base region were also obtained. The tests were performed at Mach numbers from 0.40 to 1.10, at angles of attack from -4 to +20 degrees and at angles of sideslip from -6 to +6 degrees, all at a Reynolds number of 6.56 million per meter (2.0 million per foot). Author

N72-22884*# Israel Program for Scientific Translations, Ltd., Jerusalem.
INTERPLANETARY FLIGHT AND COMMUNICATION. VOLUME 2, NO. 6: SUPERAVIATION AND SUPERARTILLERY
Nikolai Alekseevich Rynin 1971 234 p Transl. into ENGLISH of the book "Mezhplanetnye Soobshcheniya: Superaviatsiyai Superartilleriyaa" Leningrad, 1971 Sponsored by NASA and NSF
(NASA-TT-F-645; TT70-50116) Avail: NTIS CSCL 22A

Superaviation and superartillery are discussed to show that they are closely linked in regard to the methods of solving the problems encountered. All investigations are considered dealing with high-altitude flights within the terrestrial atmosphere, and the firing of projectiles from guns to large distances. In addition, four monographs are included whose contents are closely related to superaviation, the first of which also deals with superartillery. These are: (1) data on the properties of the atmosphere up to high altitudes, (2) the living conditions for human being at high altitudes, (3) the influence of large accelerations on human beings, and (4) the operation of instruments measuring the acceleration during flight. Author

N72-22885*# Israel Program for Scientific Translations, Ltd., Jerusalem.
INTERPLANETARY FLIGHT AND COMMUNICATION. VOLUME 2, NO. 4: ROCKETS
N. A. Rynin 1971 212 p refs Transl. into ENGLISH from "Mezhplanetnye Soobshcheniya" Leningrad, 1929 p 1-207 Sponsored by NASA and NSF
(NASA-TT-F-643; TT70-50114) Avail: NTIS CSCL 22B

The state-of-the-art of direct-reaction engines in 1928 is described. The principle of reaction engines is discussed, and the history of rocket and direct-reaction engine development is summarized. Special emphasis is given to the work of D. P. Ryabushinskii, Giovanni Penna, and Antonio de Stefano. Theoretical investigations proposed by various scientists for clarifying the operation of reaction engines are outlined, and the fundamentals of interplanetary flight are explained. N.E.N.

N72-22886*# MB Associates, San Ramon, Calif.
A SHUTTLE AND SPACE STATION MANIPULATOR SYSTEM FOR ASSEMBLY, DOCKING, MAINTENANCE CARGO HANDLING AND SPACECRAFT RETRIEVAL (PRELIMINARY DESIGN). VOLUME 1: MANAGEMENT SUMMARY Final Report
7 Jan. 1972 119 p refs 4 Vol.
(Contract NAS9-11943)
(NASA-CR-115480; MB-R-71/105-Vol-1) Avail: NTIS CSCL 22B

A preliminary design is established for a general purpose manipulator system which can be used interchangeably on the shuttle and station and can be transferred back and forth between them. Control of the manipulator is accomplished by hard wiring from internal control stations in the shuttle or station. A variety of shuttle and station manipulator operations are considered including servicing the Large Space Telescope; however, emphasis is placed on unloading modules from the shuttle and assembling the space station. Simulation studies on foveal stereoscopic viewing and manipulator supervisory computer control have been accomplished to investigate the feasibility of their use in the manipulator system. The basic manipulator system consists of a single 18.3 m long, 7 degree of freedom (DOF), electrically acutated main boom with an auxiliary 3 DOF electrically actuated, extendible 18.3 m maximum length, lighting, and viewing boom. A 3 DOF orientor assembly is located at the tip of the viewing boom to provide camera pan, tilt, and roll.
Author

N72-22887*# MB Associates, San Ramon, Calif.
A SHUTTLE AND SPACE STATION MANIPULATOR SYSTEM FOR ASSEMBLY, DOCKING, MAINTENANCE, CARGO HANDLING AND SPACECRAFT RETRIEVAL (PRELIMINARY DESIGN). VOLUME 2: CONCEPT DEVELOPMENT AND SELECTION Final Report
7 Jan. 1972 194 p refs 4 Vol.
(Contract NAS9-11943)
(NASA-CR-115481; MB-R-71/105-Vol-2) Avail: NTIS CSCL 22B

The overall program background, the various system concepts considered, and the rationale for the selected design are described. The concepts for each subsystem are also described and compared. Details are given for the requirements, boom configuration and dynamics, actuators, man/machine interface and control, visual system, control system, environmental control and life support, data processing, and materials. N.E.N.

N72-22888*# MB Associates, San Ramon, Calif.
A SHUTTLE AND SPACE STATION MANIPULATOR SYSTEM FOR ASSEMBLY, DOCKING, MAINTENANCE, CARGO HANDLING AND SPACECRAFT RETRIEVAL (PRELIMINARY DESIGN). VOLUME 3: CONCEPT ANALYSIS. PART 1: TECHNICAL Final Report
7 Jan. 1972 251 p refs 4 Vol.
(Contract NAS9-11943)
(NASA-CR-115482-Vol-3-Pt-1) Avail: NTIS CSCL 22B

Information backing up the key features of the manipulator system concept and detailed technical information on the subsystems are presented. Space station assembly and shuttle cargo handling tasks are emphasized in the concept analysis because they involve shuttle berthing, transferring the manipulator boom between shuttle and station, station assembly, and cargo handling. Emphasis is also placed on maximizing commonality in the system areas of manipulator booms, general purpose end effectors, control and display, data processing, telemetry, dedicated computers, and control station design. N.E.N.

N72-22889*# MB Associates, San Ramon, Calif.
A SHUTTLE AND SPACE STATION MANIPULATOR SYSTEM FOR ASSEMBLY, DOCKING, MAINTENANCE, CARGO HANDLING AND SPACECRAFT RETRIEVAL (PRELIMINARY DESIGN). VOLUME 3: CONCEPT ANALYSIS. PART 2: DEVELOPMENT PROGRAM Final

Report
7 Jan. 1972 11 p refs 4 Vol.
(Contract NAS9-11943)
(NASA-CR-115484; MB-R-71/105-Vol-3-Pt-2) Avail: NTIS CSCL 22B

A preliminary estimate is presented of the resources required to develop the basic general purpose walking boom manipulator system. It is assumed that the necessary full scale zero g test facilities will be available on a no cost basis. A four year development effort is also assumed and it is phased with an estimated shuttle development program since the shuttle will be developed prior to the space station. Based on delivery of one qualification unit and one flight unit and without including any ground support equipment or flight test support it is estimated (within approximately + or - 25%) that a total of 3551 man months of effort and $17,387,000 are required. Author

N72-22890*# MB Associates, San Ramon, Calif.
A SHUTTLE AND SPACE STATION MANIPULATOR SYSTEM FOR ASSEMBLY, DOCKING, MAINTENANCE, CARGO HANDLING AND SPACECRAFT RETRIEVAL (PRELIMINARY DESIGN). VOLUME 4: SIMULATION STUDIES Final Report
7 Jan. 1972 57 p refs 4 Vol.
(Contract NAS9-11943)
(NASA-CR-115483; MB-R-71/105-Vol-4) Avail: NTIS CSCL 22B

Laboratory simulations of three concepts, based on maximum use of available off-the-shelf hardware elements, are described. The concepts are a stereo-foveal-peripheral TV system with symmetric steroscopic split-image registration and 90 deg counter rotation; a computer assisted model control system termed the trajectory following control system; and active manipulator damping. It is concluded that the feasibility of these concepts is established. N.E.N.

N72-22891*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
WORLD DATA CENTER A (ROCKETS AND SATELLITES) CATALOGUE OF DATA. VOLUME 1, PART A: SOUNDING ROCKETS Data received by WDC-A for rockets and satellites, 7 March 1947 - 31 December 1971
Mar. 1972 360 p
(NASA-TM-X-68822) Avail: NTIS HC $6.00/MF $0.95 CSCL 16D

A cumulative listing of all scientifically successful rockets that have been identified from various sources is presented. The listing starts with the V-2 rocket launched on 7 March 1947 and contains all rockets identified up to 31 December 1971. Author

N72-22892*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PARAMETRIC ANALYSIS OF PERFORMANCE AND DESIGN CHARACTERISTICS FOR ADVANCED EARTH-TO-ORBIT SHUTTLES
Edward A. Willis, Jr., William C. Strack, and John A. Padrutt Washington Apr. 1972 31 p refs
(NASA-TN-D-6767; E-6749) Avail: NTIS CSCL 22B

Performance, trajectory, and design characteristics are presented for (1) a single-stage shuttle with a single advanced rocket engine, (2) a single-stage shuttle with an initial parallel chemical engine and advanced engine burn followed by an advanced engine sustainer burn, (3) a single-stage shuttle with an initial chemical engine burn followed by an advanced engine burn, and (4) a two-stage shuttle with a chemical propulsion booster stage and an advanced propulsion upper stage. The ascent trajectory profile includes a brief initial vertical rise; zero-lift flight through the sensible atmosphere; variational steering into an 83-kilometer by 185-kilometer intermediate orbit; and a fixed, 460-meter per second allowance for subsequent maneuvers. Results are given in terms of burnout mass fractions (including structure and payload), trajectory profiles, propellant loadings, and burn times. These results are generated with a trajectory analysis that includes a parametric variation of the specific impulse from 800 to 3000 sevonds and the specific engine weight from 0 to 1.0. Author

N72-22893*# Chrysler Corp., New Orleans, La. Space Div.
FOREBODY AND VERTICAL STABILIZER EFFECTS ON DIRECTIONAL STABILITY OF A REUSABLE LOX/RP (061) BOOSTER AR 12161-2 SADSAC/Space Shuttle Wind Tunnel Test Data Report
C. E. Roth, L. L Watts, and R. W. Ainsworth Mar. 1972 273 p
(Contract NAS8-4016)
(NASA-CR-120027; DMS-DR-1209) Avail: NTIS CSCL 22B

Results are presented of a wind tunnel test on the directional stability of space shuttle booster configurations. The test was conducted at the 14-inch trisonic tunnel starting 6 December 1971 and continued through 11 December 1971 for a total of 66 occupancy hours. Configurations tested included a cylindrical body with two axisymmetrical noses, one with and without canopy, one delta wing, located in two positions, five vertical tails (including a V tail), two having split rudders, ventral fins, two sets of chines, three airbreathing engine pods, and rocket engine shrouds. The model scale was 0.003366. Author

N72-22894*# Chrysler Corp., New Orleans, La. Space Div.
HEAT TRANSFER INVESTIGATION OF TWO LANGLEY RESEARCH CENTER DELTA WING CONFIGURATIONS AT A MACH NUMBER OF 10.5, VOLUME 1 SADSAC/Space Shuttle Wind Tunnel Test Data Report
R. H. Eaves (ARO, Inc.), T. D. Buchanan (ARO, Inc.), J. D. Warmbrod (NASA, Marshall Space Flight Center), and C. B. Johnson (Langley Research Center) Mar. 1972 75 p refs
(Contract NAS8-4016)
(NASA-CR-120036; DMS-DR-1224-Vol-1) Avail: NTIS CSCL 22B

Heat transfer tests for two delta wing configurations were conducted in the hypervelocity wind tunnel. The 24-inch long models were tested at a Mach number of approximately 10.5 and at angles of attack of 20, 40, and 60 degrees over a length Reynolds number range from 5 million to 23 million on 4 May to 4 June 1971. Heat transfer results were obtained from model surface heat gage measurements and thermographic phosphor paint. Author

N72-22895*# Chrysler Corp., New Orleans, La. Space Div.
HEAT TRANSFER INVESTIGATION OF LANGLEY RESEARCH CENTER TRANSITION MODELS AT A MACH NUMBER OF 8, VOLUME 2 SADSAC/Space Shuttle Wind Tunnel Test Data Report
R. K. Matthews (ARO, Inc.), W. R. Martindale (ARO, Inc.), J. D. Warmbrod, and C. B. Johnson Mar. 1972 132 p ref
(Contract NAS8-4016)
(NASA-CR-120045; DMS-DR-1224-Vol-2) Avail: NTIS CSCL 22B

The results are presented of a wind tunnel test program to determine aerodynamic heat transfer distributions on delta body and straight body transition models of the space shuttle. Heat transfer rates were determined by the phase-change paint technique on Stycast and RTV models using Tempilag as the surface temperature indicator. The nominal test conditions were: Mach 8, length Reynolds numbers of 5 million and 7.4 million, and angles of attack of 20, 40, and 60 deg. Model details, test conditions, and reduced heat transfer data are included. Data reduction of the phase-change paint photographs was performed by utilizing a new technique. Author

N72-22896*# Chrysler Corp., New Orleans, La.
SURFACE PRESSURE AND INVISCID FLOW FIELD PROPERTIES OF THE NORTH AMERICAN ROCKWELL DELTA-WING ORBITER FOR NOMINAL MACH NUMBER OF 8, VOLUME 2 SADSAC/Space Shuttle Wind Tunnel Test Data Report
R. K. Matthews, W. R. Martindale, and J. D. Warmbrod Mar.

1972 59 p
(Contract NAS8-4016)
(NASA-CR-120046; DMS-DR-1225-Vol-2) Avail: NTIS CSCL 22B

The results are presented of a wind tunnel test program to determine surface pressures and flow field properties on the space shuttle orbiter configuration. The tests were conducted in September 1971. Data were obtained at a nominal Mach number of 8 and a free stream unit Reynolds number of 3.7 million per foot. Angle of attack was varied from 10 to 50 deg in 10-deg increments. Author

N72-22897*# Chrysler Corp., New Orleans, La.
SURFACE PRESSURE AND INVISCID FLOW FIELD PROPERTIES MCDONNELL-DOUGLAS BOOSTER NOMINAL MACH NUMBER OF 8, VOLUME 3 SADSAC/Space Shuttle Wind Tunnel Test Data Report
R. K. Matthews, W. R. Martindale, and J. D. Warmbrod Mar. 1972 52 p
(Contract NAS8-4016)
(NASA-CR-120047; DMS-DR-1225-Vol-3) Avail: NTIS CSCL 22B

The results are presented of a wind tunnel test program to determine surface pressures and flow field properties on the space shuttle booster configuration. The tests were conducted in September 1971. Data were obtained at a nominal Mach number of 8 at angles of attack of 40 and 50 deg and at a free stream unit Reynolds number of 3.7 million per foot. Author

N72-22898*# Chrysler Corp., New Orleans, La. Space Div.
INVESTIGATION OF THE MCDONNELL-DOUGLAS ORBITER AND BOOSTER SHUTTLE MODELS IN PROXIMITY AT MACH NUMBERS 2.0 TO 6.0. VOLUME 7: PROXIMITY DATA AT MACH 4 AND 6, INTERFERENCE FREE AND LAUNCH VEHICLE DATA SADSAC/Space Shuttle Wind Tunnel Test Data Report
L. L. Trimmer (ARO, Inc.), D. A. Love (LMSC, Huntsville, Ala.), J. P. Decker (NASA Langley), K. L. Blackwell (NASA Marshall), W. T. Strike (ARO, Inc.), and J. M. Rampy (Northrop, Inc., Huntsville, Ala.) Mar. 1972 237 p ref
(Contract NAS8-4016)
(NASA-CR-119985; DMS-DR-1108-Vol-7) Avail: NTIS CSCL 22B

Aerodynamic data obtained from a space shuttle abort stage separation wind tunnel test are presented. The .00556 scale models of the orbiter and booster configuration were tested in close proximity using dual balances during the time period of April 21 to April 27 1971. Data were obtained for both booster and orbiter over an angle of attack range from -10 to 10 deg for zero degree sideslip angle. The models were tested at several relative incidence angles and separation distances and power conditions. Plug nozzles utilizing air were used to simulate booster and orbiter plumes at various altitudes along a nominal ascent trajectory. Powered conditions were 100, 50, 25 and 0 percent of full power for the orbiter and 100, 50 and 0 percent of full power for the booster. Pitch control effectiveness data were obtained for both booster and orbiter with power on and off. In addition, launch vehicle data with and without booster power were obtained utilizing a single balance in the booster model. Data were also obtained with the booster canard off in close proximity and for the launch configuration. Author

N72-22899*# Chrysler Corp., New Orleans, La. Space Div.
AERODYNAMIC STATIC STABILITY CHARACTERISTICS OF THE MSFC 33-FOOT PUMP FED BOOSTER AT HIGH ANGLES OF ATTACK SADSAC/Space Shuttle Wind Tunnel Test Data Report
Thomas Hamilton Mar. 1972 81 p
(Contract NAS8-4016)
(NASA-CR-120051; DMS-DR-1245) Avail: NTIS CSCL 22B

Experimental aerodynamic investigations were conducted in the 14-inch trisonic wind tunnel during early February 1972 on a 0.00340 scale model of the 33-foot diameter space shuttle pump fed booster configuration. The basic configuration tested was a 40-deg cone/cylinder. Six component aerodynamic force and moment data were recorded over a Mach number range from 0.6 to 5.0, angles-of-attack from 50 to 90 deg at 0 deg sideslip and over a sideslip range from -10 to +10 deg at 60 and 80 deg angles-of-attack. Primary configuration variables were fin area and body cutout size. Author

N72-22900*# Hamilton Standard Div., United Aircraft Corp., Windsor Locks, Conn.
ADVANCED EXTRAVEHICULAR PROTECTIVE SYSTEMS STUDY, VOLUME 1
James G. Sutton, Philip F. Heimlich, and Edward H. Tepper Mar. 1972 104 p refs 2 Vol.
(Contract NAS2-6021)
(NASA-CR-114383) Avail: NTIS CSCL 22B

An appraisal was made of advanced portable and emergency life support systems concepts for space station, space shuttle, lunar base, and Mars EVA missions. Specifications are given, and the methodology is described. Subsystem studies and systems integration efforts are summarized. Among the conclusions are the following: (1) For long duration missions, a configuration incorporating a regenerable CO2 control subsystem and a thermal control subsystem utilizing a minimum of expendables decreases the vehicle penalty of present configurations. (2) For shorter duration missions, a configuration incorporating an expendable water thermal control subsystem is the most competitive subsystem; regenerable CO2 control subsystems if properly developed are competitive with nonregenerable counterparts. (3) The CO2 reduction and oxygen reclamation withing the parent vehicle is only competitive when there are three or more parent vehicle resupply periods. (4) For long duration emergency systems of one hour or more, inherent redundancy within the primary configuration to provide emergency thermal control is the most competitive approach. Author

N72-22901*# Hamilton Standard Div., United Aircraft Corp., Windsor Locks, Conn.
ADVANCED EXTRAVEHICULAR PROTECTIVE SYSTEMS STUDY, VOLUME 2
James G. Sutton, Philip F. Heimlich, and Edward H. Tepper Mar. 1972 220 p refs 2 Vol.
(Contract NAS2-6021)
(NASA-CR-114384) Avail: NTIS CSCL 22B

The results of the subsystem studies are presented. Initial identification and evaluation of candidate subsystem concepts in the area of thermal control, humidity control, CO2 control/O2 supply, contaminant control and power supply are discussed. The candidate concepts that were judged to be obviously noncompetitive were deleted from further consideration and the remaining candidate concepts were carried into the go/no go evaluation. A detailed parametric analysis of each of the thermal/humidity control and CO2 control/O2 supply subsystem concepts which passed the go/no go evaluation is described. Based upon the results of the parametric analyses, primary and secondary evaluations of the remaining candidate concepts were conducted. These results and the subsystem recommendations emanating from these results are discussed. In addition, the parametric analyses of the recommended subsystem concepts were updated to reflect the final AEPS specification requirements. A detailed discussion regarding the selection of the AEPS operating pressure level is presented. Author

N72-22902*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
GRAVITY GRADIENT TORQUE PROFILES OVER AN ORBIT FOR ARBITRARY MODULAR SPACE STATION CONFIGURATIONS IN THE Y-POP AND INERTIAL HOLD MODES
David J. McGill 22 Mar. 1972 30 p refs
(NASA-TM-X-64651) Avail: NTIS CSCL 22B

For several proposed configurations of the modular space station, the gravity gradient torque distribution is examined for both Y-POP and inertial hold orbits. The necessary equations are

derived to allow for solar panel gimbaling, and a procedure is established which will allow any desired space station configuration to be built up. Results indicated that solar panel gimbaling can be a significant factor in the torque distribution in Y-POP orbits. In addition, for the two configurations that were plotted, bias torque magnitudes varied widely in inertial hold modes. Author

N72-22903*# Chrysler Corp., New Orleans, La. Space Div.
AERODYNAMIC STABILITY AND DRAG CHARACTERISTICS OF A PARALLEL BURN/SRM ASCENT CONFIGURATION AT MACH NUMBERS FROM 0.6 TO 4.96 SADSAC/Space Shuttle Wind Tunnel Test Data Report
J. Frank Sims (NASA. Marshall Space Flight Center) and Thomas Hamilton Apr. 1972 583 p
(Contract NAS8-4016)
(NASA-CR-120053; DMS-DR-1249) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

Experimental aerodynamic investigations were conducted in the NASA/MSFC 14-inch trisonic wind tunnel during March 1972 on a .003366 scale model of a solid rocket motor version of the space shuttle ascent configuration. The configuration consisted of a parallel burn solid rocket motor booster on an external H-O centerline tank orbiter. Six component aerodynamic force and moment date were recorded over an angle of attack range from -10 to 10 deg at zero degrees sideslip and over a sideslip range from -10 to 10 deg at 0, +6, and -6 deg angle of attack. Mach number ranged from 0.6 to 4.96. The performance and stability characteristics of the complete ascent configuration and build-up, and the effects of variations in tank diameter, orbiter incidence, fairings and positioning of the solid rocket motors and tank fins were determined. Author

N72-22904*# North American Rockwell Corp., Downey, Calif. Space Div.
MODULAR SPACE STATION PHASE B EXTENSION Quarterly Review
E. G. Cole and R. A. Berglund 4 Nov. 1971 301 p
(Contract NAS9-9953)
(NASA-CR-115546; MSC-02467; SD-71-576; QR-3) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

The modular space station concept and preliminary design are outlined. The premission operations, reference programs, baseline program costs, sortie analysis, and program options are covered. N.E.N.

N72-22905*# North American Rockwell Corp., Downey, Calif. Space Div.
MODULAR SPACE STATION PHASE B EXTENSION PRELIMINARY PERFORMANCE SPECIFICATION. VOLUME 2: PROJECT
10 Dec. 1971 88 p
(Contract NAS9-9953)
(NASA-CR-115545; MSC-02469-Vol-2; SD-71-215-2-Vol-2) Avail: NTIS CSCL 22B

The four systems of the modular space station project are described, and the interfaces between this project and the shuttle project, the tracking and data relay satellite project, and an arbitrarily defined experiment project are defined. The experiment project was synthesized from internal experiments, detached research and application modules, and attached research and application modules to derive a set of interface requirements which will support multiple combinations of these elements expected during the modular space station mission. The modular space station project element defines a 6-man orbital program capable of growth to a 12-man orbital program capability. The modular space station project element specification defines the modular space station system, the premission operations support system, the mission operations support system, and the cargo module system and their interfaces. Author

N72-22906*# North American Rockwell Corp., Downey, Calif. Space Div.
MODULAR SPACE STATION PHASE B EXTENSION NASA ADMINISTRATOR'S REVIEW
3 Dec. 1971 144 p
(Contract NAS9-9953)
(NASA-CR-115544; SD-71-582) Avail: NTIS CSCL 22B

The preliminary design, reference program, costs, and sortie and program options for the modular space station are outlined. The Phase B has a barbell configuration baseline with a manipulator. The baseline includes two capability plateaus, a 6-man station followed after five years by growth to a 12-man station. It is concluded that a common development approach is the most cost effective and flexible system. The system includes a module to support automated payload servicing, a set of sortie labs, and the cargo modules, RAMs, and space station modules. These would be developed and operated in conjunction with the space shuttle. N.E.N.

N72-22907*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HYPERSONIC AERODYNAMICS AND ENTRY-MANEUVER: AEROTHERMODYNAMIC INTERACTIONS FOR TWO LIFTING ENTRY VEHICLES
James P. Arrington and William C. Woods Washington May 1972 61 p refs
(NASA-TN-D-6753; L-8072) Avail: NTIS CSCL 22C

The longitudinal, directional, and lateral static stability and control characteristics of a delta lifting body and a delta-wing body were obtained at a Mach number of 20 in helium for operational Reynolds numbers over an angle-of-attack range of -4 deg to 55 deg. The aerodynamic characteristics of the wing body were then evaluated in an entry study to examine the effects of vehicle performance on the aerothermodynamic parameters associated with constant and variable angle-of-attack modes for a 1500-n. mi. cross range. The experimental results indicated that the vehicles were stable, except for neutral directional stability for the wing-body shape, and could be trimmed over the operational angle-of-attack range; however, the wing-body vehicle had adverse yaw due to roll control. This roll-yaw coupling was not examined for the lifting body. The trajectory analysis indicated that a 17-percent decrease in performance required little change in the constant angle-of-attack entry mode and, in turn, resulted in a small decrease in the total heat load. For the pitch-modulated entry, the performance decrease required the pitch maneuver to begin earlier during entry and to last longer in order to meet the 1500-n. mi. cross range without a major heating penalty. The performance reduction also had little effect on the maximum laminar radiation equilibrium temperature over a major portion of the lower surface of the wing-body vehicle regardless of the entry mode. Author

N72-22908# European Space Research and Technology Center, Noordwijk (Netherlands).
OPTIMIZATION OF THE PARAMETERS OF THE THERMAL MODEL OF A SATELLITE, USING THE TEST DATA AND AN INVERSE METHOD [OPTIMISATION DES PARAMETRES DU MODELE THERMIQUE D'UN SATELLITE PAR UNE METHODE INVERSE A PARTIR DES DONNEES DES ESSAIS]
A. Accensi and M. Toussaint Paris ESRO Jan. 1969 137 p refs In FRENCH; ENGLISH summary
(ESRO-TM-135-ESTEC) Avail: NTIS

The results of an attempt at an automatic interpretation of the measurements made during thermal testing of a satellite are given. The problem to be solved was the following: given the environmental conditions obtained during the test and the temperatures measured at various points on the satellite, is it possible to derive the mathematical model of the satellite, i.e. the complete set of parameters necessary to reconstitute its thermal behavior purely by means of calculation? In answering the question, the authors have developed a numerical method based on regression analysis, which method has led to encouraging results. Certain difficulties, however, have arisen, in particular: (1)

the ambiguities inherent in the very notion of a mathematical model, (2) the high number of parameters to be taken in consideration, and (3) the influence of measurement errors which rule out the hope that, in the present state of the art, interpretation of thermal tests could be entirely conducted by a numerical program. Author (ESRO)

N72-22909# Teleplan A.B., Solna (Sweden).
CORIOLIS EFFECT ON SOUNDING ROCKET IMPACT POINTS
J. Martin-Loef and S. Lundin Jan. 1972 14 p
(S-8-3; RTA500004/U50208) Avail: NTIS

An analytical expression for the impact point deflection of sounding rockets due to the rotation of the earth is derived by calculating the Coriolis perturbation for an idealized parabolic trajectory. Error estimates are given and show that the simplified expressions are quite adequate for field use. Nomograms giving the westward and righthand deflection at the latitude of ESRANGE (68 deg N) are presented. Author (ESRO)

N72-22910# Technologieforschung G.m.b.H., Stuttgart (West Germany).
INVESTIGATION OF PARTICULARLY ECONOMICAL LAUNCH VEHICLES Final Report [STUDIE BESONDERS WIRTSCHAFTLICHER TRAEGERSYSTEME SCHLUSSBERICHT]
9 Dec. 1971 75 p Partly in GERMAN and partly in ENGLISH Prepared for Bundesmin. fuer Wiss. Forsch.
(Contract RV-I-2-MK-V14/71)
(TF-015-71) Avail: NTIS

A proposal is given for a low cost European launch vehicle, and technical solutions leading to cost reduction are discussed. The vehicle configuration is of modular conception, has 1000 tons take-off weight, and 10 tons payload weight in low earth orbit. Unnecessary developmental risk is minimized by using the low cost booster concept and by limiting development to that absolutely necessary. The possible technical solutions in configuration, trajectory, guidance and control, propulsion system, structure and reliability are discussed. ESRO

N72-22276*# Aerospace Corp., El Segundo, Calif.
SATELLITE TEMPERATURE CORRELATION OF PREDICTED, TEST, AND FLIGHT DATA
H. Apoian *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 425-443 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 20M

N72-22289*# European Space Technology Center, Delft (Netherlands).
SOME CONTAMINATION PROBLEMS IN THE EUROPEAN TD SATELLITE
J. Dauphin, G. Schamle, and A. Zwaal *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 613-627 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 22B

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N72-22911# Bureau of Mines, Minneapolis, Minn. Twin Cities Mining Research Center.
HIGH-SPEED PHOTOGRAPHY STUDIES OF LABORATORY CRATERING IN TENNESSEE MARBLE PLATES
Joseph L. Condon and Dennis V. DAndrea Washington 1972 22 p refs
(BM-RI-7613) Avail: NTIS

High speed movies were taken of crater experiments in two-dimensional plates of Tennessee marble to study craters being formed primarily by stress wave action. The contribution of gas action to the cratering process was minimized because the two-dimensional models did not contain the expanding gases from the explosive. Four burdens were studied for solid plates and one burden for a segmented plate. After cratering, the plates were reassembled for dye penetrant studies of fracturing. Fly rock velocities were calculated and related to the degree of fracturing, and compared with those from quarry shots. In general, the smallest burdens produced the highest fly rock velocities and the least amount of fracturing. Fly rock velocities compared favorably with initial fly rock velocities in quarry blasts, but did not show step accelerations due to gas effects as did the quarry blasts. The test with a segmented plate was used to simulate cratering in a jointed material and showed that stress wave effects may be important for crater formation in jointed rocks. Author

N72-22912# National Aerospace Lab., Tokyo (Japan).
ON ANALYSIS OF LARGE DEFORMATION PROBLEMS OF BEAM
Hideo Izumi Nov. 1971 10 p refs In JAPANESE; ENGLISH summary
(NAL-TR-246) Avail: NTIS

A finite element solution procedure was derived for extensive deformation in compressible beams using incremental theory and Galerkin's method. Numerical solutions were obtained for two cases; (1) postbuckling responses of an axially loaded beam, and (2) load deflection relationships of a beam subjected to axial load and end moment. Small initial deflection must be assumed for the postbuckling problem. The eigenfunctions for linear buckling theory were used as the initial deflection. Numerical solutions were compared with separate solutions obtained using the shooting method and linear elastic theory. Author

N72-22913*# Syracuse Univ., N.Y.
FATIGUE CRACK TIP DEFORMATION AND FATIGUE CRACK PROPAGATION
Tai Shan Kang and H. W. Liu Feb. 1972 125 p refs
(Grant NGR-33-022-105)
(NASA-CR-120890) Avail: NTIS CSCL 20K

The effects of stress ratio, prestress cycling and plate thickness on the fatigue crack propagation rate are studied on 2024-T351 aluminum alloy. Fatigue crack propagation rate increases with the plate thickness and the stress ratio. Prestress cycling below the static yield strength has no noticeable effect on the fatigue crack propagation rate. However, prestress cycling above the static yield strength causes the material to strain harden and increases the fatigue crack propagation rate. Crack tip deformation is used to study the fatigue crack propagation. The crack tip strains and the crack opening displacements were measured from moire fringe patterns. The moire fringe patterns were obtained by a double exposure technique, using a very high density master grille (13,400 lines per inch). Author

N72-22914# Cranfield Inst. of Technology (England). Structural and Aerospace Dynamics Group.
ACTIVE DAMPING IN STRUCTURES
John Roorda Jul. 1971 38 p refs
(Cranfield-Aero-8) Avail: NTIS

The development of a system for dissipating excess energy from flexible structures by the action of dynamic forces is discussed. The use of active feedback control mechanisms for damping out excess vibrations is described. The basic active damping scheme involves the introduction of a control force on the structure through a feedback network whose input is dictated by the motion of the structure. The feedback network is composed of a sensor, an electro-hydraulic servomechanism, and a forcer. The action of the system through a simple spring-mass

construction is analyzed. Nine different control schemes were investigated and their relative merits are examined. Author

N72-22915*# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
FINITE ELEMENT ANALYSIS OF LARGE TRANSIENT ELASTIC-PLASTIC DEFORMATIONS OF SIMPLE STRUCTURES, WITH APPLICATION TO THE ENGINE ROTOR FRAGMENT CONTAINMENT/DEFLECTION PROBLEM
Richard W.-H. Wu and Emmett A. Witmer Jan. 1972 326 p refs
(Grant NGR-22-009-339)
(NASA-CR-120886; ASRL-TR-154-4) Avail: NTIS HC $6.00/MF $0.95 CSCL 20K

Assumed-displacement versions of the finite-element method are developed to predict large-deformation elastic-plastic transient deformations of structures. Both the conventional and a new improved finite-element variational formulation are derived. These formulations are then developed in detail for straight-beam and curved-beam elements undergoing (1) Bernoulli-Euler-Kirchhoff or (2) Timoshenko deformation behavior, in one plane. For each of these categories, several types of assumed-displacement finite elements are developed, and transient response predictions are compared with available exact solutions for small-deflection, linear-elastic transient responses. The present finite-element predictions for large-deflection elastic-plastic transient responses are evaluated via several beam and ring examples for which experimental measurements of transient strains and large transient deformations and independent finite-difference predictions are available. Author

N72-22916*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NONLINEAR AXISYMMETRIC FLEXURAL VIBRATION OF SPHERICAL SHELLS
Haruo Kunieda Washington Apr. 1972 51 p refs
(NASA-TN-D-6776; A-4076) Avail: NTIS CSCL 20K

Axisymmetric responses are presented of a nonshallow thin-walled spherical shell on the basis of nonlinear bending theory. An ordinary differential equation with nonlinearity of quadratic as well as cubic terms associated with variable time is derived. The derivation is based on the assumption that the deflection mode is the sum of four Legendre polynomials, and the Galerkin procedure is applied. The equation is solved by asymptotic expansion, and a first approximate solution is adopted. Unstable regions of this solution are discussed. Author

N72-22917*# Naval Postgraduate School, Monterey, Calif.
A COMPUTER PROGRAM FOR THE GEOMETRICALLY NONLINEAR STATIC AND DYNAMIC ANALYSIS OF ARBITRARILY LOADED SHELLS OF REVOLUTION, THEORY AND USERS MANUAL
Robert E. Ball Washington NASA Apr. 1972 105 p refs
(Contract NASA Order L-16438)
(NASA-CR-1987) Avail: NTIS CSCL 20K

A digital computer program known as SATANS (static and transient analysis, nonlinear, shells) for the geometrically nonlinear static and dynamic response of arbitrarily loaded shells of revolution is presented. Instructions for the preparation of the input data cards and other information necessary for the operation of the program are described in detail and two sample problems are included. The governing partial differential equations are based upon Sanders' nonlinear thin shell theory for the conditions of small strains and moderately small rotations. The governing equations are reduced to uncoupled sets of four linear, second order, partial differential equations in the meridional and time coordinates by expanding the dependent variables in a Fourier sine or cosine series in the circumferential coordinate and treating the nonlinear modal coupling terms as pseudo loads. The derivatives with respect to the meridional coordinate are approximated by central finite differences, and the displacement accelerations are approximated by the implicit Houbolt backward difference scheme with a constant time interval. The boundaries of the shell may be closed, free, fixed, or elastically restrained. The program is coded in the FORTRAN 4 language and is dimensioned to allow a maximum of 10 arbitrary Fourier harmonics and a maximum product of the total number of meridional stations and the total number of Fourier harmonics of 200. The program requires 155,000 bytes of core storage. Author

N72-22918# Advisory Group for Aerospace Research and Development, Paris (France).
THE ACCUMULATION OF FATIGUE DAMAGE IN AIRCRAFT MATERIALS AND STRUCTURES
J. Schijve (Natl. Aerospace Lab., Amsterdam) Jan. 1972 125 p refs
(AGARD-AG-157; AGARDograph-157) Avail: NTIS

The available literature in the field of fatigue damage accumulation is surveyed and analyzed. Physical aspects of fatigue damage accumulation are discussed, including interaction and sequence effects. Empirical trends observed in variable-amplitude tests are summarized including the effects of a high preload, periodical high loads, ground-to-air cycles and the variables pertaining to program loading, random loading and flight-simulation loading. This also includes results from full-scale fatigue test series. Various theories on fatigue damage accumulation are recapitulated. The significance of these theories for explaining empirical trends as well as for estimating fatigue properties as a design problem is evaluated. For the latter purpose reference is made to the merits of employing experience from previous designs. Fatigue testing procedures are discussed in relation to various testing purposes. Emphasis is on flight-simulation tests. Finally several recommendations for further work are made. Author

N72-22919# Illinois Univ., Urbana. Dept. of Aeronautical and Astronautical Engineering.
SOME APPROXIMATIONS IN THE NONLINEAR VIBRATIONS OF UNSYMMETRICALLY LAMINATED PLATES
James A. Bennett 26 Apr. 1972 30 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in Sep. 1972
Avail: NTIS

By combining a linear approximation for unsymmetric laminates and a nonlinear approximation for isotropic plates, an approximation was obtained to the equations describing the nonlinear vibrations of unsymmetric laminates. Solutions were obtained for hinged angle ply laminates and compared to the exact solutions. A discussion of the effect of the quadratic nonlinear coupling term is also given. It is shown that the accuracy is dependent on the laminate material, laminate orientation, and plate aspect ratio. It is also shown that the effect of the nonlinear approximation is greater than the effect of the linear approximation. Author

N72-22920# Institut fuer Chemie der Treibstoffe, Berghausen (West Germany).
EXPLOSION TESTS IN STEEL PIPES. INVESTIGATION BY THE USE OF MODELS OF THE RESISTANCE OF STEEL CONSTRUCTIONAL MEMBERS TO DETONATIVE LOADS ACTING ON THE INTERIOR [SPRENGVERSUCHE IN STAHLROHREN. MODELLUNTERSUCHUNG ZUR AUSLEGUNG VON WIDERSTANDSFAEHIGEN BAUKOERPERN AUS STAHL GEGEN DETONATIVE INNENBELASTUNG]
H. Hommel 1970 72 p refs In GERMAN
(ICT-4/70) Avail: NTIS

Model tests were carried out in steel tubes of St 35 quality, and in welded boiler plate tubes with inner diameters ranging from 100 to 720 mm and wall thicknesses of 5 and 10 mm, to determine the resistivity of steel structural members to interior detonation loads. The influence of charger and container geometry was investigated for tubes open at both ends. The specific loading volume is found to be 0.72 kg/cu m atm, respectively 0.515 kg/cu m atm (kg explosive per cubic meter enclosed space and atm static operating pressure), as allowable or

respectively burst loading volume. These results are compared with a formula for closed steel containers. Materials for load alleviating inner linings are investigated. ESRO

N72-22921# Laboratorium fur Betriebsfestigkeit, Darmstadt (West Germany).
VIBRATION STABILITY INVESTIGATIONS ON CRUCIFORM St 37 STEEL K WELDS [SCHWINGFESTIGKEITS-UNTERSUCHUNG AN KREUZSTOESSEN MIT K-NAHT AUS DEM GRUNDWERKSTOFF STAHL ST 37]
E. Haibach 18 Dec. 1970 53 p refs In GERMAN; ENGLISH summary Sponsored by Deut. Ausschuss fuer Stahlbau
(FB-90) Avail: NTIS; Lab. fuer Betriebsfestigkeit: 25 DM

The results of statistically evaluated S-N tests and programmed fatigue tests are presented for a cruciform St37 steel K weld, produced in special quality (full penetration, dressed weld surface) and in normal quality (incomplete fusion, no dressing). The special quality specimens exhibit a high fatigue resistance. Fracture occurred outside the weld in the steel cross section, although an X-ray examination showed small weld defects. Analysis of the tests showed that small defects should be accepted. In normal quality specimen fracture starts at the root of penetration. In this case fatigue strength, depends on the degree of incomplete fusion. ESRO

N72-22922# Institut Franco-Allemand de Recherches, St. Louis (France).
BLAST LOAD BEHAVIOR OF ORDINARY CONCRETE AND RESIN CONCRETE PLATES: SURVEY OF WORK CARRIED OUT AT ISL [TENUE EN SOUFFLE DE DALLES EN BETON CLASSIQUE ET EN BETON DE RESINE: VUE D'ENSEMBLE DES TRAVAUX DE L'ISL]
M. Schaffar and C. Thery 7 Jun. 1971 31 p refs In FRENCH
(Contract DTEN-70.70.198)
(ISL-NB-5/71) Avail: NTIS

Studies of the blast resistance of concrete structures are reported, and the test facilities (blast simulators, and shock tubes) are described. The work done on conventional reinforced concrete plates has yielded a blast resistant type of plate; construction of these plates requires good cohesion between concrete and steel. The improved mechanical performance of synthetic resin reinforced concrete should lead to lighter plates which are easier to manufacture. The use of this material would allow prefabrication and the adoption of blast resistant forms. A bibliography of reports issued under this project is included. ESRO

N72-22923# Institut Franco-Allemand de Recherches, St. Louis (France).
DYNAMIC DEFORMATION CALCULATION OF CIRCULAR CANTILEVER OR SUPPORTED PLATES UNIFORMLY LOADED BY A STEP VARYING PRESSURE [CALCUL DE LA DEFORMATION DYNAMIQUE DE PLAQUES CIRCULAIRES ENCASTREES OU APPUYEES, UNIFORMEMENT CHARGEES PAR UN ECHELON DE PRESSION]
M. Schaffar 21 Dec. 1970 60 p refs In FRENCH
(Contract DTEN-70.70.198)
(ISL-25/70) Avail: NTIS

Thin circular, elastic homogeneous plates either freely suspended or embedded were submitted to step increases in uniform pressure; theoretical and numerical analyses were performed with the aim of ascertaining the exact value of the maximum dynamic/static ratio of rise of camber and deformation. After determination of the first eight- natural oscillations, the movement of the plates was studied. For rise of camber the maximum ratio was 2:1 for embedded plates and 2:05 for freely suspended plates (nu equals 0.3 accuracy 0.1 percent). For deformation the maximum ratio was 2.5 in both cases. ESRO

N72-22924# British Iron and Steel Research Association, London (England). Engineering Dept.
ECONOMICS OF DESIGN IN HIGH-STRENGTH STRUCTURAL STEELS
A. A. Doncaster and M. W. Haxton Nov. 1971 24 p refs
(PB-205103; EG/A/11/71) Avail: NTIS CSCL 13M

The steels considered are weldable structural steels to BS 4360. In particular, those steels which most closely match those previously included in BS 15 (mild steel of for general structural purposes) and BS 968 (high yield stress (welding quality) structural steel) are featured, together with the new Grade 55 steel in BS 4360. It is shown that considerable economics can be made by the use of high strength steels; 10% savings were shown in the multi-story frame study. In addition, reductions in both weight of steel-work and construction depth, of up to 30% and 25% respectively, were achieved. Author (GRA)

N72-22925# British Iron and Steel Research Association, London (England). Engineering Dept.
THE INFLUENCE OF MATERIAL PROPERTIES ON THE PLASTIC HINGE ROTATION AND DEFLECTION OF AN ELASTICALLY RESTRAINED BEAM LOADED AT THE CENTRE
J. E. Dibley Nov. 1971 39 p refs
(PB-205100; EG/A/12/71) Avail: NTIS CSCL 13M

The use of hot-rolled Universal beam and column sections in structures designed on the basis of simple plastic theory is at present restricted by limits to the flange width/thickness (B/T) ratio. The limits are based on an empirical formula, designed to avoid premature plastic buckling of the compression flange when a plastic hinge forms and is then required to undergo rotation while plastic hinges develop at further points. This report examines the plastic hinge rotation requirements for the severe case of a beam elastically restrained at its ends and loaded by a concentrated load at the center. Author (GRA)

N72-22926# Naval Research Lab., Washington, D.C. Strength of Metals Branch.
BASIC CONCEPTS FOR DESIGN AGAINST STRUCTURAL FAILURE BY FATIGUE CRACK PROPAGATION
Thomas W. Crooker 13 Jan. 1972 38 p refs
(AD-736618; NRL-7347) Avail: NTIS CSCL 13/13

Structural fatigue has only recently become recognized as a phenomenon of major importance. Fatigue is not confined to individual machinery components, but only within the past two decades has fatigue of entire structures become a factor of importance. This new concept results from advances in high-strength alloy development combined with advances in fabrication technology. These emerging factors have combined to produce massive monolithic structures which are expected to sustain repeated applications of high stresses in service. Traditional concepts of metal fatigue, which are based solely on crack initiation as a failure criterion, are inadequate to deal with modern structural fatigue problems. Cracks readily initiate in large high-strength structures under fatigue loading, and the crucial aspect of the problem is crack propagation. Fatigue design of such structures must rely on safe-life periods between inspections and prevention of catastrophic failure through fracture-safe design considerations. Author (GRA)

N72-22927# Office of Civil Defense, Washington, D.C.
A DISCUSSION AND TABULATION OF THE DATA USED TO CONSTRUCT THE CHARTS IN THE OCD STANDARD METHOD FOR FALLOUT GAMMA RADIATION SHIELDING ANALYSIS
Edward T. Bramlitt (Naval School, Civil Engr. Corps Officers, Port Hueneme, Calif.) and Charles M. Eisenhauer (NBS, Washington, D. C.) Dec. 1971 75 p refs
(AD-736203; OCD-TR-70) Avail: NTIS CSCL 13/13

The report presents the data used to construct the charts required for shielding analysis by the OCD standard method for fallout gamma radiation shielding analysis. It is provided by the Architectural and Engineering Development Division, Technical Services Directorate, Office of Civil Defense, to serve as a reference for persons conducting research, instructing, or writing computer programs in the areas of shielding analysis. The data

given were verified in a number of ways, and attempts were made to use consistent data from one table to the next.
Author (GRA)

N72-22928# Naval Postgraduate School, Monterey, Calif.
A COMPUTER STUDY OF THE BUCKLING OF AN IMPERFECT CYLINDRICAL SHELL M.S. Thesis
Joseph John Dantone Sep. 1971 40 p refs
(AD-736530) Avail: NTIS CSCL 20/11

An existing computer program for the geometrically nonlinear analysis of arbitrarily loaded shells of revolution was modified to incorporate initial geometric imperfections into the buckling solution of an axially loaded circular cylindrical shell. Several different boundary conditions were considered, and the predicted buckling loads were examined to determine the significance of the initial imperfections and the boundary conditions for the shell stability problem. Author (GRA)

N72-22929# Naval Postgraduate School, Monterey, Calif.
DYNAMIC BUCKLING OF SHALLOW SPHERICAL CAPS SUBJECTED TO A NEARLY AXISYMMETRIC STEP PRESSURE LOAD M.S. Thesis
John Alan Burt Sep. 1971 37 p refs
(AD-736531) Avail: NTIS CSCL 20/11

The behavior of shallow spherical caps subjected to axisymmetric and nearly axisymmetric step pressure loads is examined using a digital computer program for the geometrically nonlinear analysis of arbitrarily loaded shells of revolution. A criterion for dynamic buckling under the nearly axisymmetric load is proposed and critical buckling pressures are determined for both loading conditions for a large range of cap sizes. A numerical convergence study is conducted to verify the accuracy of the results. Author (GRA)

N72-22930# Anamet Labs., Inc., Berkeley, Calif.
ANALYSIS OF STRUCTURAL SHELLS WITH TRANSVERSE SHEAR DEFORMATION Final Technical Report, Jun. 1969 - Feb. 1971
Richard L. Citerley Nov. 1971 203 p
(Contract F33615-70-C-1019; AF Proj. 1467)
(AD-736052; AFFDL-TR-71-116) Avail: NTIS CSCL 20/11

The report describes the results of an investigation for the numerical analysis procedures of shells of revolution and consultation on the execution of shell problems at the Air Force Flight Dynamics Laboratory Facilities. A computer program for the analysis of the thick shells of revolution, the analysis of thin shells subjected to torsion and the theory upon which it is based is presented. Detailed input instructions and three example problems are included to illustrate the added capabilities of the computer program. Author (GRA)

N72-22931# Watervliet Arsenal, N.Y.
CONSTITUTIVE MATRIX AND FINITE ELEMENT FORMULATION FOR A DEFORMATION THEORY OF PLASTICITY
P. C. T. Chen Oct. 1971 20 p refs
(DA Proj. 1T0-61101-A-91A)
(AD-736349; WVT-7110) Avail: NTIS CSCL 20/11

The report is concerned with three general approaches in the finite element formulation of small strain plasticity problems, using the Hencky-Nadai deformation theory as a mathematical model for the material behavior. The finite stress-strain matrix due to Havner is adapted into the secant modulus or direct-iterative approach. Two quasi-linear incremental forms of constitutive matrix are derived. An explicit relation is also given for the calculation of plastic strain increments in the incremental-initial strain approach. Particular attention is given to the finite element formulation using a combined moduli approach. A close similarity between two types of plasticity theories is shown.
Author (GRA)

N72-22932# Stanford Univ., Calif.
INSTABILITY OF SPHERICAL CAPS AND COMPLETE SPHERES
Philippe Jacques Jean-Marie Lebouc Sep. 1971 80 p refs
(Contract DAAJ02-67-C-0031; DA Proj. 1F1-62204-A-170)
(AD-736346; USAAVLABS-TR-69-61) Avail: NTIS CSCL 20/11

The report is concerned with the instability behavior of spherical shells for which, so far as can be traced from a broad literature survey, no application of this technique has been considered. Moreover, it is an area in which the scatter between experimental results is normally great and in which there is still considerable analytical effort being made. The report demonstrates that the Southwell Plot approach gives an interpretation of experimental data which is consistent with the findings of small displacement computations. Author (GRA)

N72-22933# Stanford Univ., Calif.
EFFECT OF FIBER DIRECTION ON THE INSTABILITY OF SINGLE-LAYER RESIN-IMPREGNATED GLASS-CLOTH CYLINDERS UNDER TORSION
Milton Harold Bank, II Sep. 1971 66 p refs
(Contract DA-44-177-AMC-115(T); DA Proj. 1F1-62204-A-170)
(AD-736345; USAAVLABS-TR-69-63) Avail: NTIS CSCL 11/9

One hundred twenty-eight tests on 65 single-layer open-weave glass-cloth resin-impregnated shells with five different fiber orientations were made. The report discussed these tests, the apparatus in which they were carried out, and the instrumentation used to make the appropriate observations. Additionally, it presents a statistical analysis of the results. This analysis indicates that fiber direction is significant. It influences both stability and stiffness. Generally speaking, the higher the strength the lower the stiffness. It is significant to note that the Southwell Plot which is generally accepted for column data interpretation is shown equally pertinent to this problem.
Author (GRA)

N72-22934# Naval Civil Engineering Lab., Port Hueneme, Calif.
REDUCTION OF STRESSES IN BURIED STRUCTURES Final Report, Sep. 1968 - Feb. 1971
S. K. Takahashi and R. N. Murtha Dec. 1971 100 p refs
(NCEL Proj. 51-009)
(AD-736601; NCEL-TN-1199) Avail: NTIS CSCL 13/3

Tests were performed in Event DIAL PACK on 1- and 3-foot diameter steel cylinders with hemispherical end caps to obtain information on the dynamic behavior of structures containing fluid (a) internally pressurized and (b) with backpacking. The four test structures were oriented with their longitudinal axes parallel to the surface and normal to a radius through ground zero. The data were used to compare the variation of the parameters of internal pressurization and backpacking and to check the results of a two-dimensional, nonlinear, large deformation computer code developed for this task. The 3-foot diameter models were designed according to the recently developed optimization equations by NCEL. Author (GRA)

N72-22935# Brown Univ., Providence, R.I. Div. of Applied Mathematics.
ON DETERMINING THE NATURE OF INSTABILITY IN NONCONSERVATIVE PROBLEMS
Raymond H. Plaut 1971 12 p refs
(Contract N00014-67-A-0191-0009; Grant
DA-31-124-ARO(D)-270; NR Proj. 041-397)
(AD-736384) Avail: NTIS CSCL 20/11

In order to determine the instability behavior of continuous nonconservative systems, the transcendental characteristic equation usually must be solved numerically. This procedure is often quite complicated, and it is therefore of interest to obtain some qualitative information on the nature of instability. In the paper expressions for the slopes of the loading-frequency curves are derived, necessary conditions for flutter and divergence instability are found, and the application of these results is discussed. Author (GRA)

N72-22936# California Univ., Berkeley. Dept. of Civil Engineering.
MODIFICATION OF THE GENERAL STRUCTURAL ANALYSIS PROGRAM (SAP) FOR DYNAMIC LOADS Final Report, Jan. - Dec. 1971
Dec. 1971 14 p refs
(Contract N62399-71-C-0003)
(AD-736237; NCEL-CR-72.009) Avail: NTIS CSCL 09/2

A general structural analysis program (SAP) was modified to permit analysis for dynamic loads by direct step-by-step integration. The theory for the development of the step-by-step method is summarized in this report. Also, a description of the use of the program and its limitation is given. Author (GRA)

N72-22937# Biot (Maurice A.), Brussels (Belgium).
NON-LINEAR EFFECT OF INITIAL STRESS ON CRACK PROPAGATION BETWEEN SIMILAR AND DISSIMILAR ORTHOTROPIC MEDIA Interim Report
Maurice A. Biot Dec. 1971 59 p refs
(Contract F44620-71-C-0092; AF Proj. 9782)
(AD-736947; AFOSR-72-0252TR) Avail: NTIS CSCL 20/11

The theory of crack propagation in orthotropic media is developed by applying the theory of incremental deformations in the vicinity of a state of initial stress. This is carried out in the context of a new approach to analytical methods and a physical analysis which takes into account plastic deformation under prestress. The state of initial stress is triaxial along the directions of elastic symmetry and the crack is parallel to these directions. An additional shear component for the initial stress is also taken into account and general conditions are derived for crack propagation, including the case of fluid injection into the crack. The analysis is first carried out for an homogeneous medium. The particular cases of an isotropic elastic medium with finite initial strain is discussed as well as the orthotropic incompressible medium. The analysis is extended to a crack between dissimilar orthotropic media with initial stress. The method of analysis leads to a number of simplifications and brings out new properties of the solutions for this type of problem.
Author (GRA)

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N72-22938 National Lending Library for Science and Technology, Boston Spa (England).
THE EFFECT OF THE INTENSITY OF AIR FLOW INVOLUTION ON MASS TRANSFER IN A FLAME
V. I. Mitkalinnyi and L. N. Usov [1971] 7 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Chernaya Met. (Moscow), no. 9, 1971 p 156-159
(NLL-M-21256-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The effect of air flow involution on the change in turbulence level was studied. Experiments were performed on isothermal (cold) jets. Mean time rate and mean square pulsation of the rate vector were measured with a thermoanemometer. Control of involution was obtained by altering in angle of inclination of the flat vanes relative to the axis of the burner. It was concluded that the distribution of mean time rate depends largely on the intensity of involution of the air flow. Author

N72-22939# Massachusetts Inst. of Tech., Cambridge. Heat Transfer Lab.
TRANSITION FROM FILM BOILING TO NUCLEATE BOILING IN FORCED CONVECTION VERTICAL FLOW
Onwuamaeze C. Iloeje, David N. Plummer, and W. M. Rohsenow Mar. 1972 77 p refs
(Grant NSF GK-17745; DSR Proj. 72718)
(DSR-72718-78) Avail: NTIS

Applications of film boiling are discussed for nuclear reactors and once-through boilers. It is concluded that the temperature difference at collapse of film boiling in forced flow is not affected by mass flux. This suggests that it could be predicted by a pool boiling correlation, while collapse heat flux is a function of mass flux. Author

N72-22940*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL HEAT TRANSFER AND FLOW RESULTS OF A CHORDWISE-FINNED TURBINE VANE WITH IMPINGEMENT, FILM, AND CONVECTION COOLING
James W. Gauntner, Jan M. Lane, Robert P. Dengler, and Robert O. Hickel Washington Apr. 1972 63 p refs Prepared jointly with Army Air Mobility Research and Development Lab., Cleveland, Ohio
(NASA-TM-X-2472; E-6547) Avail: NTIS CSCL 20M

Experimental heat transfer data are presented for a vane tested in a turbojet engine at turbine inlet gas temperatures to 1644 K (2500 F), coolant temperatures to 700 K (800 F), and coolant-to-gas flow ratios to 0.187. Methods are presented for correlating heat transfer data and obtaining coolant flow distribution through the vane. Calculated and measured coolant flow distributions and vane metal temperatures are compared.
Author

N72-22941*# Dynatherm Corp., Cockeysville, Md. Technical Summary Report
FABRICATION AND EVALUATION OF ALUMINUM HEAT PIPES
Jul. 1970 42 p refs
(Contract NAS5-11271)
(NASA-CR-122380; DTM-70-2) Avail: NTIS CSCL 20M

An evaluation is presented for the current heat pipe system on the OAO spacecraft, in order to increase its capability for future missions. A detailed analysis was made of the requirements, and approaches for the design of optimized heat pipes to meet future needs were identified. A composite wick heat pipe was developed, which has significantly higher transport capability than those of conventional wick design. Author

N72-22942# Joint Publications Research Service, Arlington, Va.
HEAT PIPE: NEW HIGH-TEMPERATURE HEAT-TRANSFER DEVICE
V. B. Yeliseyev and D. I. Sergeyev 11 Apr. 1972 109 p refs Transl. into ENGLISH of the book "Chto Takoye Teplovaya Truba" Moscow, Energiya Publishing House, 1971 134 p
(JPRS-55675) Avail: NTIS

Heat pipes are discussed from the standpoint of their development, history, operation, and application to industry and scientific research. The properties of heat pipes which determine their use in various fields of technology are summarized. Subjects presented are: (1) operating principles of more complex heat pipes; (2) engineering and technical problems of creating a heat pipe; and (3) numerical relationships of heat pipe theory and construction. Author

N72-22943# Joint Publications Research Service, Arlington, Va.
DEVICE FOR COOLING RADIATION SENSORS
Ye. I. Antonov, V. Ye. Ilin et al 3 Apr. 1972 26 p Transl. into ENGLISH from the book "Ustroystva Dlya Okhlazhdeniya Priyemnikov Izlucheniya" Leningrad, Machine Building Publishing House, 1969 p 2, 73-92, 246-248
(JPRS-55607) Avail: NTIS

Photoelectric characteristics of radiation receivers and descriptions of miniature devices for cooling them are presented. The devices are based on the utilization of the Joule-Thompson

effect, the heat of vaporization of liquids boiling at low temperatures, and the vortex effect. Semiconductor and compressed-gas cooling equipment are described. The manufacturing technology of these devices, the peculiarities of measuring low temperatures, and methods of purifying and drying working gases are discussed. Author

N72-22944*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ABLATIVE SYSTEM Patent Application
Vernon H. Gray, inventor (to NASA) Filed 4 Jun. 1971 11 p
(NASA-Case-LEW-10359-2; US-Patent-Appl-SN-150215) Avail: NTIS CSCL 20M

A carrier liquid containing ablative material bodies is supplied to a plenum chamber, one wall of which has openings in it and is exposed to a high temperature environment. The liquid and the bodies pass through the openings in the wall to form a self-replacing ablative surface. In a second embodiment the wall is comprised of honeycomb layers. Spheres containing ablative whiskers or wads, and a hardening catalyst for the carrier liquid are dispersed in the liquid. Another embodiment utilizes wicks woven of ablative material fibers, and extending through the openings in the wall and into the plenum chamber containing the carrier liquid. NASA

N72-22945*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF PREDICTED AND EXPERIMENTAL HEAT-TRANSFER AND PRESSURE-DROP RESULTS FOR AN AIR-COOLED PLUG NOZZLE AND SUPPORTING STRUTS
Edwin J. Graber, Jr. and John S. Clark Washington Apr. 1972 38 p refs
(NASA-TN-D-6764; E-6709) Avail: NTIS CSCL 20M

A calculational procedure is presented to analyze the heat-transfer and fluid-flow characteristics of a convectively air-cooled plug nozzle for a supersonic afterburning turbojet engine. An approximate method was used to calculate hot-gas stream properties for low nozzle-pressure ratios. Both an integral boundary layer technique and a simple pipe flow equation were used to calculate the hot-gas to plug-wall heat transfer coefficients. Author

N72-22946# National Physical Lab., Teddington (England). Div. of Inorganic and Metallic Structure.
STATISTICAL MECHANICAL CALCULATIONS OF PROPERTIES OF SOLID-VAPOUR INTERFACES
R. A. Hunt Sep. 1971 105 p refs
(NPL-IMS-15) Avail: NTIS

Some results are obtained for the thermal variation of the interfacial free energy and hence of other thermodynamic properties of models of solids in equilibrium with their vapors. Two types of approximation are considered: the mathematical approximation, the low temperature series expansion of the grand partition function; and the physical model, a Monte Carlo method based on the grand canonical ensemble. Both methods agree for a simple cubic lattice on both low index and stepped surfaces. The physical model of atoms restricted to lattice positions and interacting via a central potential seems inadequate to explain the experimental temperature variation of the surface free energy. Author (ESRO)

N72-22947# Explosives Research and Development Establishment, Waltham Abbey (England).
PLASTIC EXPLOSIVE RHEOLOGY
Virginia M. Chudyszewicz and W. A. Dukes Apr. 1971 17 p refs
(ERDE-TN-33) Avail: NTIS

Two samples of Plastic Explosive No. 4 (PE4) have been examined by parallel-plate plastometer. Separate static and dynamic theoretical analyses have enabled the derivation of the yield stress together with the shear-hardening coefficient (approximately zero), and the plastoviscosity as a function of strain-rate together with the (logarithmic) flow curve. It is concluded that parallel-plate plastometry is a useful laboratory method for characterising the rheological properties of PE4. Author (ESRO)

N72-22948# Societe Nationale Industrielle Aerospatiale, Cannes (France).
STUDY OF HEAT TRANSMISSION IN HONEYCOMB STRUCTURES [ETUDE DE LA TRANSMISSION DE CHALEUR DANS LES STRUCTURES ALVEOLAIRES]
A. Tardivo and M. Ziliani Paris ESRO Sep. 1971 148 p refs In FRENCH; ENGLISH summary
(Contract ESTEC-907170)
(ESRO-CR-47) Avail: NTIS

A theoretical and experimental study has been made of the thermal conductivity of honeycomb sandwich structures in vacuum (pressure less than 0.0001 torr) and over the ambient temperature range 0 to 40 C. The theoretical study consisted in deriving formulae that enabled a conductivity to be calculated that was equivalent to that of a homogeneous material having the same geometrical dimensions as the test piece. Experimental verification, in general in agreement with the theoretical study, was carried out over the ambient temperature range. Author (ESRO)

N72-22949# Rome Univ. (Italy). Inst. of Physics.
CALCULATIONS OF THERMODYNAMIC FUNCTIONS NEAR THE CRITICAL POINT OF FLUIDS
E. Lentini and M. Vincentini-Missoni 8 Sep. 1971 35 p refs
(Nota-Interna-334) Avail: NTIS

A phenomenological equation of state which obeys the scaling hypothesis and gives a good representation of data in the critical region of fluids, was used to calculate other thermodynamic functions, in particular the free energy per unit volume and the internal energy. The gravity effect on the internal energy was evaluated according to different models and compared with experimental results. Large discrepancy with experimental data was found for all equations of state used. ESRO

N72-22950# British Iron and Steel Research Association, London (England). Physics Dept.
HEAT TRANSFER IN REGENERATORS
R. D. Collins, L. F. Daws, and J. V. Taylor Nov. 1971 20 p refs
(PB-205164; BISRA-P/26/55) Avail: NTIS CSCL 13A

The performance of a regenerative system was analyzed in a general manner, and methods are described for calculating gas and air temperatures at various positions within the regenerator throughout the reversal period. A simple example was studied using a desk calculator to ascertain whether the numerical procedure was possible. Author (GRA)

N72-22951# Army Foreign Science and Technology Center, Charlottesville, Va.
SYMMETRICAL HEATING AND COOLING OF A PLATE IN A DIRECT FLOW
A. S. Telegin and V. P. Zavarzin 28 Oct. 1971 9 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chem. Met. (Moscow), no. 3, 1970 p 171-174
(AD-736548; FSTC-HT-23-375-72) Avail: NTIS CSCL 20/3

The solution of the problem of symmetrical heating and cooling of a plate is produced in this article by the method of separation of variables. Author (GRA)

N72-22952# Stanford Univ., Calif. Dept. of Mechanical Engineering.
COMPACT HEAT EXCHANGERS AND THERMODYNAMIC INVESTIGATIONS Final Summary Report
A. L. London Nov. 1971 24 p refs
(Contract Nonr-225(91); NR Proj. 090-342)

(AD-736261; TR-76) Avail: NTIS CSCL 13/1

The 24 year project had as its major goals: The generation, largely by model experiments, of the basic data needed for the heat transfer and flow friction design of compact heat exchangers; The formulation of heat exchanger design theory; The solution of special problems in heat exchanger design such as the optimum configuration of flow headers and the transient thermal response, as required for the development of system controls. The report provides: A listing of technical report titles; A listing of published papers cross-referenced with the source technical reports. GRA

N72-22953# ARO, Inc., Arnold Air Force Station, Tenn.
FREE-FLIGHT INVESTIGATION OF ABLATION EFFECTS ON THE STABILITY OF CONICAL REENTRY CONFIGURATIONS Final Report, 15 Apr. - 18 Jun. 1971
C. J. Welsh and G. L. Winchenbach AEDC Feb. 1972 34 p refs
(Contract F40600-72-C-0003; ARP Proj. VG0119)
(AD-736455; AEDC-TR-71-242; ARO-VKF-TR-71-190) Avail: NTIS CSCL 16/3

A 1000-ft aeroballistics range was used to obtain free-flight stability and drag data for slightly blunted 10-deg semiangle cones with and without ablation occurring on the conical skirts. The configurations investigated included ones having fore- and aft-positioned ablation sleeves, as well as one with a skirt material which did not ablate. The investigation was conducted for a Mach number near 14 and a Reynolds number, based on cone length and free-stream conditions, of about 55,000. GRA

N72-22954# University Engineers, Inc., Norman, Okla.
HEAT TRANSFER BY DIRECT FLAME CONTACT: FIRE TESTS, PHASE 1 Final Report
J. R. Welker and C. M. Sliepcevich Jul. 1971 55 p refs
(Contracts DOT-CG-11775-A)
(AD-736395; UE-122-FR) Avail: NTIS CSCL 13/12

A laboratory study of the rate of heat transfer by convection and radiation to an object in direct contact with a flame was undertaken. The purpose was to devise a simplified mathematical procedure for computing the total heat transfer under these conditions based on these measurements. Another object of this work was to obtain sufficient information to design full scale field tests which can be used to test the validity of the mathematical model and the heat transfer rates as obtained in the laboratory. Author (GRA)

N72-22278*# Philco-Ford Corp., Palo Alto, Calif.
SPACE SIMULATION AND RATE DEPENDENT RADIATION TESTING
H. E. Pollard and D. C. Briggs *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 453-460 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 20M

N72-22295*# Dow Corning Corp., Midland, Mich.
DEVELOPMENT OF A SILICONE ABLATOR FOR HIGH-HEAT-FLUX AND HIGH-SHEAR-RATE CONDITION
Richard A. Campbell, James A. Ramseyer, and Arnold Huntress *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 725-748 refs (See N72-22250 13-11)
Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 20M

N72-22296*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
AN EVALUATION OF FLIGHT DATA FOR THE APOLLO THERMAL PROTECTION SYSTEM
E. P. Bartlett (Aerotherm Corp., Mountain View, Calif.) and D. M. Curry *In its* Space Simulation 1972 p 749-768 refs (See N72-22250 13-11)
(Paper-67) Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 20M

N72-22305*# McDonnell Aircraft Corp., St. Louis, Mo.
THERMAL TESTING TECHNIQUES FOR SPACE SHUTTLE THERMAL PROTECTION SYSTEM PANELS
B. G. Cox *In* NASA. Goddard Space Flight Center Space Simulation 1972 p 881-897 (See N72-22250 13-11)
(Contracts NAS8-26115; NAS9-11221)
(Paper-77) Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 20M

N72-22308*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TECHNIQUES ASSOCIATED WITH THERMAL-VACUUM TESTING OF THE OAO-C HEAT PIPES
James P. Marshburn *In its* Space Simulation 1972 p 933-946 refs (See N72-22250 13-11)
(Paper-80) Avail: NTIS; SOD $4.50 as NAS 1-21:298 CSCL 20M

34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N72-22955* George Washington Univ., Washington, D.C.
TECHNOLOGY ASSESSMENT: UNDERSTANDING THE SOCIAL CONSEQUENCES OF TECHNOLOGICAL APPLICATIONS
Raphael G. Kasper, ed. 1972 301 p refs Presented at a Ser. of Seminars on the Program of Policy Studies in Sci. and Technol., Washington, D. C., Jan. 1969 - May 1970
(Grant NGR-09-010-030)
(NASA-CR-126242; LC-71-161909) Avail: Praeger Publishers, 111 4th Ave., New York, N. Y. 10003 CSCL 05B

Papers are presented on technology assessment processes and actions. The discussions cover information systems, management, social functions, government and citizen involvement, and attacks on science and technology. For individual titles, see N72-22956 through N72-22965.

N72-22956* George Washington Univ., Washington, D.C.
ASSESSMENT INFORMATION SYSTEMS
Clarence H. Danhof *In its* Technol. Assessment: Understanding the Social Consequences of Technol. Appl. 1972 p 7-28 refs (See N72-22955 13-34)
Avail: Praeger Publishers, 111 4th Ave., New York, N. Y. 10003 CSCL 05B

The assessment process in contemporary society and the role of the expert are discussed. The development of technology is considered in two stages: the preintroduction stage in which the developer makes the tests and decisions, and the application stage in which the user applies the technology and makes tests with different criteria. The adverse effects of death, personal injury, and collective injury are described, and resulting public actions are mentioned. The role of the experts is identified as asking relevant questions and recording observations, communicating with each other, summarizing the findings, and indicating the significance of the findings to those capable of deciding upon action. It is pointed out that the experts often disagree on facts and economic values. The basic problem is felt to be one of identifying the social significance in an assessment situation.
N.E.N.

N72-22957* Library of Congress, Washington, D.C.
TECHNOLOGY ASSESSMENT AND THE CONGRESS
Richard A. Carpenter *In* George Washington Univ. Technol. Assessment: Understanding the Social Consequences of Technol. Appl. 1972 p 29-48 refs (See N72-22955 13-34)

Avail: Praeger Publishers, 111 4th Ave., New York, N. Y. 10003 CSCL 05B

The legislative branch is considered as the major focus for technology assessment, and the functions of the Congressional Research Service in supplying Congressmen with scientific and technological development is outlined, and the need for Congress to control, assess, and integrate the various and conflicting elements for the benefit of both technology and society is stressed. The organization of the Science Policy Research Division is mentioned, and its duties in gathering facts for the increased understanding by the members of Congress are indicated. Technology assessment aspects associated with congressional committees and hearings, adequacy of advice, trends in engineering education, and the public interest are also discussed. N.E.N.

N72-22958* George Washington Univ., Washington, D.C.
THE ADVERSARY PROCESS IN TECHNOLOGY ASSESSMENT
Harold P. Green *In its* Technol. Assessment: Understanding the Social Consequences of Technol. Appl. 1972 p 49-69 (See N72-22955 13-34)
Avail: Praeger Publishers, 111 4th Ave., New York, N. Y. 10003 CSCL 05B

An Agency which would act as a responsible technological ombudsman is proposed for inclusion in the technology assessment mechanism. The agency would be charged solely with the function and responsibility to probe and identify the negative factors and present them to Congress and the public. It is felt that in the development of technology in private sectors there are assessments and controls exerted by the public. However, in governmental technology, the agencies involved tend to emphasize the useful and beneficial aspects, and it is pointed out that the administrative agencies also tend to develop unwholesome affinities to the industries they regulate. It is also felt that scientific and engineering experts have a bias in favor of accomplishing what they think can be accomplished. The proposed devil's advocate agency would investigate the areas of hazards and potential hazards, and would subject Congress to the pressures of public opinion. N.E.N.

N72-22959* George Washington Univ., Washington, D.C.
THE MANAGEMENT OF TECHNOLOGY ASSESSMENT
Louis H. Mayo *In its* Technol. Assessment: Understanding the Social Consequences of Technol. Appl. 1972 p 71-122 refs (See N72-22955 13-3;)
Avail: Praeger Publishers, 111 4th Ave., New York, N. Y. 10003 CSCL 05B

The total problem concept of technology assessment, involving a comprehensive information management activity with an objective orientation to the assessment function is discussed. A brief overview of the technology assessment function and some past experiences are given. Fragmentation of assessment systems, optimum social subsystem for examination in particular assessments, and adequacy of assessments are studied. The magnitude of the technology assessment function and the level of support required for the effective performance of this function are also discussed. One type of institutional arrangement which might produce a close approximation to the total problem assessment approach is suggested. N.E.N.

N72-22960* Association of American Universities, New York.
TECHNOLOGY ASSESSMENT IN THE EXECUTIVE OFFICE OF THE PRESIDENT
Charles V. Kidd *In* George Washington Univ. Technol. Assessment: Understanding the Social Consequences of Technol. Appl. 1972 p 123-148 refs (See N72-22955 13-34)
Avail: Praeger Publishers, 111 4th Ave., New York, N. Y. 10003 CSCL 05B

The involvement of the President with technology, directly and indirectly, and the best way in which his responsibilities can be discharged are discussed. Technology assessment is considered essential at all levels of the Executive agencies, but the capacity of the agencies for assessment is limited and needs to be supplemented within the Executive Branch. Complete centralization of technological assessment is felt to be ineffective. The role of the Executive Office in initiating proposals for Presidential action and sustaining links with Congress are outlined, and the apparatus for technology assessment is described, emphasizing the Office of Science and Technology. A significant area of technology assessment for the Executive Office is the field of environmental quality, and the duties of the Environmental Quality Council are summarized. It is suggested that it may be more effective to set up a separate organization for the restoration and protection of the environment and to define the task in terms of what is to be protected rather than in terms of technology. N.E.N.

N72-22961* Library of Congress, Washington, D.C.
THE SOCIAL FUNCTION OF TECHNOLOGY ASSESSMENT
Franklin P. Huddle *In* George Washington Univ. Technol. Assessment: Understanding the Social Consequences of Technol. Appl. 1972 p 149-173 (See N72-22955 13-34)
Avail: Praeger Publishers, 111 4th Ave., New York, N. Y. 10003 CSCL 05K

The problem of preserving the uneasy balance between a dynamic society and the equilibrium of man-environment society is discussed. Four sets of activities involved in technology assessment are considered: (1) Technology forecasting is necessary to warn of future dangers and opportunities, for effective timing, and to identify tradeoffs and alternatives. But forecasting is also chancy at best. (2) Social indicators need to be developed for the characterization of social status and measurement of social progress, as well as a better understanding of social needs. (3) With respect to technology assessment, the conflict between profitable directions of innovations and socially desirable directions is described, and a systematic way is needed to determine in advance what is technologically feasible to meet social needs. (4) National goals with respect to scientific and technological developments are also required. N.E.N.

N72-22962* Kleinfeld and Kaplan Law Offices, Washington, D.C.
TECHNOLOGY ASSESSMENT AND THE FOOD AND DRUG ADMINISTRATION
Alan H. Kaplan and Robert H. Becker *In* George Washington Univ. Technol. Assessment: Understanding the Social Consequences of Technol. Appl. 1972 p 175-194 (See N72-22955 13-34)
Avail: Praeger Publishers, 111 4th Ave., New York, N. Y. 10003 CSCL 05B

The statutory standards underlying the activities of the FDA, and the problems the Agency faces in decision making are discussed from a legal point of view. The premarketing clearance of new drugs and of food additives, the two most publicized and criticized areas of FDA activity, are used as illustrations. The importance of statutory standards in technology assessment in a regulatory setting is developed. The difficulties inherent in the formulation of meaningful standards are recognized. For foods, the words of the statute are inadequate, and for drugs, a statutory recognition of the various other objectives would be useful to the regulator and the regulated. N.E.N.

N72-22963* George Washington Univ., Washington, D.C.
TECHNOLOGY ASSESSMENT OR TECHNOLOGY HARASSMENT: THE ATTACKS ON SCIENCE AND TECHNOLOGY
Leon Green, Jr. *In its* Technol. Assessment: Understanding the Social Consequences on Technol. Appl. 1972 p 195-227 refs (See N72-22955 13-34)
Avail: Praeger Publishers, 111 4th Ave., New York, N. Y. 10003 CSCL 05B

The manner in which technology is being assessed by various groups and individuals is discussed. Attacks on science and technology (specifically military uses and funding), and the disillusionment of the public with the lack of relevance of science to the public interest and with the infallible wisdom of scientists

are described. The effects of the fear of environmental pollution are emphasized. It is concluded that the important issues of science, technology, and public policy will require a pluralistic definition of the public interest by open adversary proceedings. It is also felt that the danger is not that new technology will receive inadequate assessment for possible deleterious secondary effects, but that harassment by an overemotional political process may prevent its coming to fruition. N.E.N.

N72-22964* National Transportation Safety Board, Washington, D.C.
PROCESSES OF TECHNOLOGY ASSESSMENT: THE NATIONAL TRANSPORTATION SAFETY BOARD
Ernest Weiss *In* George Washington Univ. Technol. Assessment: Understanding the Social Consequences of Technol. Appl. 1972 p 229-258 refs (See N72-22955 13-34)
Avail: Praeger Publishers, 111 4th Ave., New York, N. Y. 10003 CSCL 05K

The functions and operations of the Safety Board as related to technology assessment are described, and a brief history of the Safety Board is given. Recommendations made for safety in all areas of transportation and the actions taken are listed. Although accident investigation is an important aspect of NTSB's activity, it is felt that the greatest contribution is in pressing for development of better accident prevention programs. Efforts of the Safety Board in changing transportation technology to improve safety and prevent accidents are illustrated. N.E.N.

N72-22965* George Washington Univ., Washington, D.C.
TECHNOLOGY ASSESSMENT AND CITIZEN ACTION
Ellis R. Mottur *In its* Technol. Assessment: Understanding the Social Consequences of Technol. Appl. 1972 p 259-286 ref (See N72-22955 13-34)
Avail: Praeger Publishers, 111 4th Ave., New York, N. Y. 10003 CSCL 05K

The importance of citizen participation in the assessment process is discussed, and a system for citizen assessment action is proposed. A national assessment system is outlined. Citizen participation is considered essential in the assessment process, and impediments to effective action taken by citizens are discussed. These impediments are finance, organization and motivation, and information. The establishment of citizens' assessment associations is proposed, whose functioning would be fostered and regulated by the Citizens' Assessment Administration. The organization, functions, and financing of these associations are described. The implications of citizen action are indicated as the extensive use of class action suits, the broad interpretation of associated costs of litigation, and the use of present scientific research as evidence to assert that it is reasonable to conclude that certain consequences are probable to occur in the future. N.E.N.

N72-22966*+ National Aeronautics and Space Administration, Washington, D.C.
MANAGEMENT: A CONTINUING LITERATURE SURVEY WITH INDEXES, 1971
Mar. 1972 132 p refs
(NASA-SP-7500(06)) Avail: NTIS CSCL 05A

An annotated bibliography of selected reports, journal articles, and other documents on the subject of management is presented. There are 450 references to documents which were originally announced in the 1971 issues of Scientific and Technical Aerospace Reports (STAR) or International Aerospace Abstracts (IAA). Subject, personal author, and corporate source indexes are included. Author

N72-22967 Defence Research Board, Ottawa (Ontario).
DEFENCE RESEARCH BOARD: THE FIRST TWENTY-FIVE YEARS
Apr. 1972 39 p In ENGLISH and FRENCH
Copyright. Avail: Issuing Activity

Defense science research in Canada is summarized, and the organization of the Board is outlined. The various research establishments and their particular fields of endeavors are briefly described, and highlights of research accomplishments are indicated. N.E.N.

N72-22968# Federal Aviation Administration, Washington, D.C. Office of Aviation Economics.
POTENTIAL FOREIGN MARKET FOR THE SALE OF SURPLUS US JET TRANSPORTS
Dec. 1971 12 p refs
(Rept-72-00185) Avail: NTIS

A potential foreign market is identified for 167 four-engine jet transports through 1972 and 22 two-engine jets, making a total market of 189 jets. Two-engine jets were considered generally as a replacement for Viscounts. The potential market and requirements by foreign airlines are summarized Author

N72-22969# Air Transport Association of America, Washington, D.C.
CANADA DURING THE AIR TRAFFIC CONTROLLERS STRIKE: WHAT IT'S LIKE WHEN A COUNTRY LOSES ITS AIR TRANSPORTATION Air Transport Report
William E. Jackman Feb. 1972 18 p
Avail: NTIS

The transportation problems caused by Canadian air traffic controller's strike are outlined. The strike cut out air mail service, all commercial and reduced military air transportation, caused critical shortages in available vegetable and fruit markets, severe shortage in available flowers, and traveling difficulties for conventions being held in Canada. Besides critical shortages in bus and rail services, the strike caused higher prices for food and other services, adverse sentiments in Parliament, and loss of support in the general population. E.H.W.

N72-22970*# Northwestern Univ., Evanston, Ill. Dept. of Political Science.
PATTERNS IN THE DEVELOPMENT OF OPERATIONS RESEARCH AND MANAGEMENT SCIENCE IN GOVERNMENT Interim Paper
Michael J. White Sep. 1971 55 p refs Presented at the 1971 Ann. Meeting of the Am. Political Sci. Assoc., Chicago, 11 Sep. 1971
(Grant NGL-14-007-058)
(NASA-CR-126132; Publ-13-71) Avail: NTIS CSCL 05A

The development of an operations research or management science (OR/MS) activity in an organization is discussed as occurring in a series of phases. Organizational aspects of the development of OR/MS in an individual case and in an institutional environment of federal civilian agencies are described. It is noted that there is some evidence that the length of time it takes an OR/MS group to develop to maturity has decreased. It is concluded that to understand the development of OR/MS in government organization, it must be considered as a problem in empirical organization theory. N.E.N.

N72-22971# Committee on Aeronautical and Space Sciences (U. S. Senate).
SOVIET SPACE PROGRAMS, 1971 (A SUPPLEMENT TO THE CORRESPONDING REPORT COVERING THE PERIOD 1966 - 1967)
Charles S. Sheldon, II (Library of Congr.) and Barbara M. DeVoe (Library of Congr.) Washington GPO Apr. 1972 79 p refs Presented to the Comm. on Aeron. and Space Sci., 92d Congr., 2d Sess., 16 Mar. 1972 Prepared by the Library of Congr. Sci. Policy Res. Div.
Avail: Comm. on Aeron. and Space Sci.

An update-study of the Soviet space program is presented with some cumulative figures since 1957, and certain complete data for the year 1971. Topics discussed include: log of space flights from January 1971 to March 4, 1972; details of unmanned and manned flights; and civil and military applications of space technology. Results of the report indicate that the

findings of the main report are still valid, and the Soviet space program is still a strong and growing enterprise. F.O.S.

N72-22972# Committee on Science and Astronautics (U. S. House).
AUTHORIZING APPROPRIATIONS TO THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION Report to accompany H.R. 14070
Miller Washington GPO 11 Apr. 1972 193 p Presented by the Comm. on Sci. and Astronaut. to the Comm. of the Whole House on the State of the Union, 92d Congr., 2d Sess., 11 Apr. 1972
(H-Rept-92-976) Avail: US Capitol, House Document Room

The appropriations made to NASA by the Committee on Science and Astronautics for fiscal year 1973 are reported. A detailed outline is given of how the multimillion dollar budget is to be used. E.H.W.

N72-22973# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
[AEROSPACE FUNDAMENTAL AND APPLIED RESEARCH] Annual Progress Report, 1971
Dec. 1971 193 p refs Original contains color illustrations
Avail: NTIS

Abstracts and summaries are presented of research conducted during 1971. Areas of investigation include the following: (1) mechanics of rarefied gases; (2) plasma dynamics; (3) compressible flows, shock wave phenomena, and hypersonic gasdynamics; (4) MHD power generation and remote sensing; (5) aerodynamic noise; (6) subsonic aerodynamics; (7) space dynamics; (8) materials science and structures; (9) rocket research; (10) space simulation, surface interactions, and trace gas analysis; (11) air cushion technology; (12) laser excitation, diagnostics, and environmental sensing; (13) flight transportation; (14) aerospace optical image processing; (15) sonic boom; and (16) industrial and architectural aerodynamics. D.L.G.

N72-22974*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PRESENT-VALUE ANALYSIS: A SYSTEMS APPROACH TO PUBLIC DECISIONMAKING FOR COST EFFECTIVENESS
Theodore T. Herbert 20 Aug. 1971 48 p refs
(NASA-TM-X-64653) Avail: NTIS CSCL 05C

Decision makers within Governmental agencies and Congress must evaluate competing (and sometimes conflicting) proposals which seek funding and implementation. Present value analysis can be an effective decision making tool by enabling the formal evaluation of the effects of competing proposals on efficient national resource utilization. A project's costs are not only its direct disbursements, but its social costs as well. How much does it cost to have those funds diverted from their use and economic benefit by the private sector to the public project? Comparisons of competing projects' social costs allow decision makers to expand their decision bases by quantifying the projects' impacts upon the economy and the efficient utilization of the country's limited national resources. A conceptual model is established for the choosing of the appropriate discount rate to be used in evaluation decisions through the technique.
Author

N72-22975*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
SPACEPORT NEWS INDEX, DECEMBER 1962 - FEBRUARY 1972
27 Mar. 1972 110 p refs
(NASA-TM-X-68324; KSC-GP-969) Avail: NTIS CSCL 05D

This index is intended to serve as a ready reference tool for the names, places and events that comprise the history of John F. Kennedy Space Center. The period covered is December 1962 through February 1972. The arrangement is alphabetical by subject; under each subject, entries are arranged alphabetically by title. To facilitate use, cross references and scope notes have been provided. Author

N72-22976# Committee on Science and Astronautics (U. S. House).
NASA AUTHORIZATION, 1973, PART 1
Washington GPO 1972 92 p refs Hearings on H.R. 12824 (superseded by H.R. 14070) before Comm. on Sci. and Astronaut., 92d Congr., 1st Sess., no. 15, 8 Feb. and 17 Mar. 1972
Avail: Comm. on Sci. and Astronaut.

Congressional hearings on the authorization of appropriations to the National Aeronautics and Space Administration are conducted. The use of appropriations for research and development, construction of facilities, and research and management programs are outlined. E.H.W.

N72-22977# Battelle Memorial Inst., Columbus, Ohio.
PUBLISHED PAPERS AND ARTICLES, 1970
Jun. 1971 36 p refs
Avail: NTIS

A bibliography of reports written by Battelle staff members and published during 1970 is presented. The categories are advanced materials and processes, engineering systems and technology, environmental control and resource management, life sciences, management planning and information systems, physical science and mathematics, and social systems. There are 766 entries. N.E.N.

N72-22978# National Science Foundation, Washington, D.C. National Science Board.
THE ROLE OF ENGINEERS AND SCIENTISTS IN A NATIONAL POLICY FOR TECHNOLOGY
1972 54 p refs
(NSB-72-1) Avail: SOD $0.45

Recommendations are summarized for policies of government aid supporting industrial technology, technical support for public goods and services, exploration of future alternatives, public understanding of technology, and technical assessment. Federal and company shares of industrial research and development spending for 1953 through 1972, trends in U.S. trade, and inventive contributions of independent inventors and small organizations are also cited. J.A.M.

N72-22979# Joint Publications Research Service, Arlington, Va.
MANAGERIAL SCIENCE AND THE NATIONAL ECONOMY
30 Mar. 1972 16 p Transl. into ENGLISH from Nauka i Zhizn. (Moscow), no. 1, 1972 p 2-7
(JPRS-55593) Avail: NTIS

A collection of magazine articles dealing with the role of computers, mathematical models, and human factors in national economic management are presented. The development of a national management system is examined. E.H.W.

N72-22980*# Boeing Co., Seattle, Wash.
STUDY OF AN INTRAURBAN TRAVEL DEMAND MODEL INCORPORATING COMMUTER PREFERENCE VARIABLES
Paul E. Holligan, Malcolm A. Coote, Charles R. Rushmer, and Michael L. Fanning Dec. 1971 342 p refs
(Contract NAS2-5969)
(NASA-CR-114418; D6-40556) Avail: NTIS CSCL 13F

The model is based on the substantial travel data base for the nine-county San Francisco Bay Area, provided by the Metropolitan Transportation Commission. The model is of the abstract type, and makes use of commuter attitudes towards modes and simple demographic characteristics of zones in a region to predict interzonal travel by mode for the region. A characterization of the STOL/VTOL mode was extrapolated by means of a subjective comparison of its expected characteristics with those of modes characterized by the survey. Predictions of STOL demand were made for the Bay Area and an aircraft network was developed to serve this demand. When this aircraft

system is compared to the base case system, the demand for STOL service has increased five fold and the resulting economics show considerable benefit from the increased scale of operations. In the previous study all systems required subsidy in varying amounts. The new system shows a substantial profit at an average fare of $3.55 per trip. Author

N72-22981# Committee on Aeronautical and Space Sciences (U. S. Senate).
CONVEY CERTAIN LANDS IN BREVARD COUNTY, FLORIDA
Washington GPO 1971 52 p Hearing on S.J. Res. 42 and H.R. 11487 before Comm. on Aeron. and Space Sci., 92d Congr., 1st Sess., 2 Dec. 1971
Avail: Comm. on Aeron. and Space Sci.

A congressional hearing is reported on a bill to authorize the administrators of NASA to convey a parcel of land in Brevard County, Fla. to a nonprofit corporation for the purpose of constructing and maintaining a chapel as a memorial to the astronauts. The parcel of land includes a 5.5 acre tract adjacent to the Vistor's Information Center at the John F. Kennedy Space Center. The proposed chapel would be a nondenominational, nonsectarian facility paid for entirely by public subscription. D.L.G.

N72-22982# Naval Research Lab., Washington, D.C.
NRL PROGRESS REPORT, MARCH 1972
Mar. 1972 52 p refs
Avail: NTIS

Charge coupling is a significant concept in metal-insulator-semiconductor electronics. The fundamental attributes are simplicity and flexibility in the provision of three basic functions (sensing, storage, and transfer) in either digital or analog format. Basically, charge-coupled devices operate by transferring charge packets, representing information, between potential wells crated at the semiconductor-insulator interface in metal-insulator-semiconductor structures. The operation, characteristics, limitations, advantages, and applications of the concept are discussed. The use of the charge-coupled concept for imaging is emphasized. Author

N72-22983# Los Alamos Scientific Lab., N.Mex.
GRAPHICAL REPRESENTATION OF TWO-VARIABLE DATA
Nicholas J. Nagy, III Nov. 1971 71 p refs
(Contract W-7405-eng-36)
(LA-4796) Avail: NTIS

Methods used to represent graphically, calculations of two independent variable data are examined. Some of the principles and theory behind the data transformation, the elimination of hidden surfaces, and the rotation of the data surface are presented. A computer code based upon these principles is described, and various programming considerations and applications are discussed. Author

N72-22984# Department of Transportation, Washington, D.C. Office of Systems Analysis and Information.
RECOMMENDATIONS FOR NORTHEAST CORRIDOR TRANSPORTATION. VOLUME 1: SUMMARY REPORT Final Report, Apr. 1970 - Sep. 1971
Myron Miller, Melvyn Cheslow, Nancy T. Ebersole, John Gerba, Donald J. Igo, Walter Velona, and Robert L. Winestone Sep. 1971 66 p refs 3 Vol.
(PB-205241) Avail: NTIS CSCL 13B

The report contains recommendations and supplementary conclusions, and discusses in summarized form the background to the Corridor's transportation problems, the general study approach, and the evaluation of alternatives. Author (GRA)

N72-22985# Department of Transportation, Washington, D.C. Office of Systems Analysis and Information.
RECOMMENDATIONS FOR NORTHEAST CORRIDOR TRANSPORTATION. VOLUME 2: MAIN REPORT Final Report, Apr. 1970 - Sep. 1971
Myron Miller, Melvyn Cheslow, Nancy T. Ebersole, John Gerba, Donald J. Igo, Walter Velona, and Robert L. Winestone Sep. 1971 316 p refs 3 Vol.
(PB-205242) Avail: NTIS HC $6.00/MF $0.95 CSCL 13B

Discussions are presented of the Northeast Corridor's population growth patterns and the region's transportation system, an evaluation methodology, descriptions of interim and long term alternative systems, and a comparative analysis of the alternatives as to their technological feasibility, economic costs and benefits, and environmental impacts for the years 1975 and 1985. GRA

N72-22986# Department of Transportation, Washington, D.C. Office of Systems Analysis and Information.
RECOMMENDATIONS FOR NORTHEAST CORRIDOR TRANSPORTATION. VOLUME 3: APPENDICES Final Report, Apr. 1970 - Sep. 1971
Myron Miller, Melvyn Cheslow, Nancy T. Ebersole, John Gerba, Donald J. Igo, Walter Velona, and Robert L. Winestone Sep. 1971 217 p refs 3 Vol.
(PB-205243) Avail: NTIS CSCL 13B

Descriptions are presented of methodology and detailed results of the Northeast Corridor's air and highway systems analysis and general environmental forecasts through 1985. GRA

N72-22987# California Univ., Irvine. Public Policy Research Organization.
SCIENCE AT THE SERVICE OF GOVERNMENT: CALIFORNIA TRIES TO EXPLOIT AN UNNATURAL RESOURCE
Robert E. Bickner 2 Dec. 1971 34 p refs
(Grant NSF GR-51)
(PB-205992) Avail: NTIS CSCL 05A

Responsible government officials and scientists in California are aware that better mechanisms for applying scientific information and analysis to public problems are needed, and they are committed to the discovery and utilization of such mechanisms. To illustrate the variety of recent efforts to translate scientific analyses into public policies, two California experiments are described: the so-called aerospace studies and the more recent assembly science and technology advisory council. The comparative advantages of two other sources of scientific advice: the not-for-profit research organizations, or think tanks, and the universities are also considered. GRA

N72-22988# Mitre Corp., McLean, Va.
MONITORING THE ENVIRONMENT OF THE NATION Final Report
C. A. Bisselle, M. C. Fowler, S. N. Goldstein, R. S. Greeley, M. J. Lilienthal, R. P. Pikul, D. M. Rosenbaum, W. D. Rowe, and D. B. Walker Apr. 1971 216 p
(Contract C-CEQ-3-71)
(PB-205989; MTR-1660) Avail: NTIS CSCL 13B

The system describes approximately 110 environmental indices and indicators and major data gaps are identified in current monitoring programs which must be reduced to allow for routine computation of the indices. The system concept features maximal exploitation of existing monitoring resources for collection of environmental data. An analysis of alternatives for computing environmental indices has identified advantages and disadvantages of centralized versus decentralized processing configurations. An implementation plan is presented to achieve an initial operating capability without requiring a selection of the final processing configuration at this time. Author (GRA)

N72-22989# Mitre Corp., McLean, Va.
MONITORING THE ENVIRONMENT OF THE NATION. APPENDICES Final Report

C. A. Bisselle, M. C. Fowler, S. N. Goldstein, R. S. Greeley, M. J. Lilienthal, R. P. Pikul, D. M. Rosenbaum, W. D. Rowe, and D. B. Walker Apr. 1971 746 p refs
(Contract C-CEQ-3-71)
(PB-205990; MTR-1660-A) Avail: NTIS HC $9.00/MF $0.95 CSCL 13B

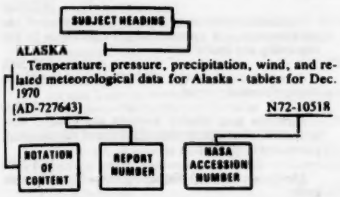
Appendices are presented on research into providing a design concept for a system to monitor the nation's environment. The data describes approximately 110 environmental indices and indicators and identifies major data gaps in current monitoring programs which must be reduced to allow for routine computation of the indices. The appendices included the following topics: Detailed discussion of potential indices to be output by a national environmental monitoring system; Analysis of cost and value of proposed indices; Technical alternatives and technical development opportunities; and Federal program descriptions.
GRA

N72-22990# Air Force Academy, Colo. Frank J. Seiler Research Lab.
PRELIMINARY ANALYSIS OF THE SELF-TENDING RIGID AIRFOILS FOR THE HYDROFOIL WATER CONVEYANCE Interim Report
Robert M. L. Baker, Jr. and Roger W. Gallington Dec. 1971 19 p refs Presented at AIAA 3d Tech. Symp. on Aero/Hydronautics of Sailing, 20 Nov. 1971
(AF Proj. 7905)
(AD-737354; SRL-TR-72-0001) Avail: NTIS CSCL 20/4

A theoretical analysis of the regions of stability and performance of the rigid-air-foil propulsion system for the hydrofoil sailcraft is presented. The trailing-edge flap is either geared so as to move in proportion to the airfoil-axis or fixed (at negative camber) relative to the airfoil. A limited stability region in which the airfoils are self-tending is investigated using a flap-angle to airfoil-angle gear ratio vs. distance of airfoil-mast behind the quarter chord plot. The chordwise motion of the airfoil relative to the mast (pivot) is found to be essential. The stability is found to be better and overall aerodynamic performance is enhanced for higher apparent winds. Aside from the ability to point higher into the apparent wind (due to a larger lift-to-drag ratio), best overall craft performance is obtained on a beam reach. The broadest range of wind angles, for which the craft is self-tending, is obtained for a fixed positive flap angle (actually, a negative camber is thereby implied). Author (GRA)

SUBJECT INDEX

TYPICAL SUBJECT INDEX LISTING



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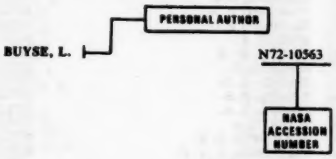

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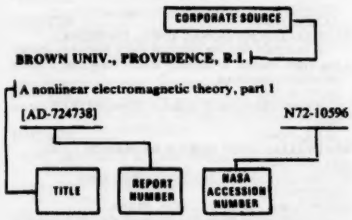

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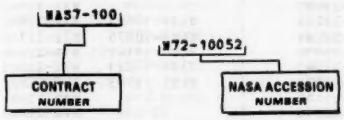

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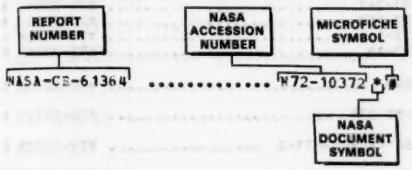

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